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WEB-BASED ENTRY LEVEL MATHEMATICS TEST

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
in
Computer Science


by
Okbun Baek
March 2007

WEB-BASED ENTRY LEVEL MATHEMATICS TEST

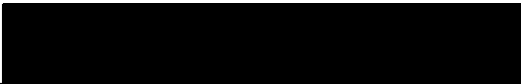
A Project
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by
Okbun Baek
March 2007

Approved by:


Kerstin Voigt, Computer Science

03/15/07
Date


Richard Botting


Ernesto Gomez

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ABSTRACT

The motivation and idea of this project came from my PHP programming ability and mathematical background. Entry Level Mathematics (ELM) examination is a verification of coverage of three years of mathematics in high school. So, all new undergraduate students entering the California State University are required to take the ELM test. Students who have demonstrated proficiency in the mathematics on the SAT, ACT or Advanced Placement Exams are exempt. If they are not exempt, they must take ELM test or take other classes that California State University suggests.

Web-based Entry Level Mathematics Test (WebELMT), my project, is a web-based ELM test site for CSUSB students where they can practice for the ELM test on the Internet. The features of WebELMT are as follows: Web based GUI to access the system any time and anywhere, open-source WebELMT tools integrated and implemented with Linux, Apache, MySQL, PHP, and LaTeX, PHP used for generating dynamic Web pages, modular based system for easy upgrade, back-end database in which all the results from WebELMT tools are stored. Particularly, LaTeX is a high-quality typesetting

system. It includes features designed for the production of technical and scientific documentation. Therefore, the LaTeX document system is a very appealing system for the display of mathematics content on the web-browser.

On WebELMT, the administrator manages ELM questions, ELM tests, and student accounts. And student can take three major ELM tests (Numbers and Data, Algebra, Geometry), can take timed(90 minutes) or untimed ELM tests, and can check his/her ELM test scores.

ACKNOWLEDGMENTS

I would like to express my deep gratitude to many people whose help have been crucial to my success in completing my project. First of all, I am very thankful to Professor Voigt, my project advisor, for her direction and wise guidance to my project. Secondly, I owe a great deal to Professor Botting and Professor Gomez, two committee members, whose supervision and advice have contributed to my study.

My heartfelt appreciation also goes out to Kwon Soo Han, the systems administrator and Nam Kim, information technology consultant who have helped me during the progress of working on my project. They have been generous with their time and have provided helpful advice and careful guidance in working out certain problems.

Finally, I would like to thank my husband and daughters who have always supported me and have been a source of much encouragement.

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CHAPTER ONE

INTRODUCTION

1.1 Background

This project is the result of my mathematical background and ideas about web programming. When I was first starting my computer science master project, I knew new undergraduate students entering the California State University, who had not demonstrated proficiency in mathematics on the SAT, ACT or Advanced Placement Exams, were required to take the ELM test. As a result, I thought web-programming to practice ELM questions was a good my master's project. Fortunately, I majored in mathematics in Korea. When I wrote my master's thesis in Korea, I used the LaTeX document system. Therefore, I started my project, WebELMT, using LaTeX, PHP web-programming and MYSQL database. LaTeX is a document preparation system for high-quality typesetting. PHP is a widely-used general-purpose scripting language that is especially suited for Web development and can be embedded into HTML. MYSQL is a multithreaded, multi-user, SQL Database Management System.

1.2 Purpose of the Project

The primary purpose of the project is to develop a web-site where students can practice ELM questions. This project, WebELMT, is separated into two components. One is system administrator and the other is students. The tasks of a system administrator are to manage student logins, student test result, ELM tests, and ELM questions. Among these tasks, managing ELM questions using the LaTeX document system is a complicated and time-consuming job, which also needs some mathematical background. This project, WebELMT, will improve the performance of the web-ELM-test using LaTeX.

The secondary purpose of the WebELMT project is to help students to pass the ELM exam easily and quickly. To this end, students can practice three categories (Numbers and Data, Algebra, Geometry) separately and take entire ELM tests. Students can see the answers and confirm their test scores. If they know their weak category, they can practice questions in this category repeatedly. After practicing the ELM tests several times, they can pass the ELM exam easily. So, WebELMT will offer a convenient opportunity to pass the ELM exam quickly.

1.3 Organization of Documentation

In the remaining sections of this documentation, Chapter 2 describes the software requirements specification of WebELMT, Chapter 3 provides a description of the system architecture and detailed design, Chapter 4 describes the system tests, Chapter 5 is the maintenance and user manual and finally, Chapter 6 concludes the project and includes suggestions for future developments.

CHAPTER TWO

SOFTWARE REQUIREMENTS SPECIFICATION

2.1 Introduction

2.1.1 Purpose

The purpose of WebELMT project is to provide a framework for effective and efficient ELM test management in a web environment. In order to do that, WebELMT will use the PHP programming tool and Latex typesetting system. So, WebELMT will be operated through the Web browser in a ubiquitous and timeless manner. WebELMT can be accessed on computers on the worldwide web. Particularly, using LaTeX, WebELMT will provide a high quality ELM test system. On the web browser, the administrator inputs a LaTeX question in LaTeX format, it is saved in MySQL, and it is converted to a PNG file in PHP engine, and finally the LaTeX question is displayed nicely on the web. Consequently WebELMT will be able to offer a convenient and effective Web ELM practice test system.

2.1.2 Scope of the Project

WebELMT project provides can manage student accounts, students' test score, ELM tests, and individual ELM questions.

The functions of WebELMT project are as follows:

- Create student account
- Delete student account
- Create ELM test
- Delete ELM test
- Edit ELM test
- Create ELM questions
- Delete ELM questions
- Modify ELM questions
- Manage student test score
- Provide ELM questions answer
- Set-up timed ELM test

2.1.3 Definitions, Acronyms, and Abbreviations

- DBMS - Database Management System
- HTML - Hyper Text Markup Language
- HTTP - Hyper Text Transfer Protocol

The client/server protocol that defines how messages are formatted and transmitted on the World Wide Web

- IP - Internet Protocol
- LAN - Local Area Network
- MySQL - MySQL is a popular and robust database that supports key subsets of SQL on both Linux and Unix system
- PHP - PHP is a widely-used general-purpose scripting language that is especially suited for Web development
- LaTeX - LaTeX is a high-quality typesetting system; it includes features designed for the production of technical and scientific documentation
- WAN - Wide Area Network

2.1.4 Overview

The format of the rest of this project is as follows. Section 2.1 is an introduction that contains an overview of the entire software requirements specification. It defines the scope and purpose of the project and the requirements document, and the terms

used in the SRS. In section 2.2, an overall description of the product and its requirements including product perspective, system interface, user interface, hardware/software interface, and product functions will be discussed. Lastly, software specific requirements will be discussed.

2.2 Overall Description

2.2.1 Product Perspective

WebELMT consists of a computer server with Web and database server applications. The server is loaded with Apache for Web server, PHP for internal Web programming, and MySQL for the back-end database. Also, a document preparation system such as LaTeX is installed in the WebELMT for ELM question displaying on the web.

2.2.2 System Interface

WebELMT mainly consists of three components: WebELMT server, Database, and LaTeX document system. The core part of this system is the WebELMT server. The system interfaces provide the administrator with three important roles to work with the WebELMT system. The administrator's three roles are the management of questions, the management of tests, and the management

of student accounts. When the administrator input LaTeX question file on the web-browser, it is converted into PNG file in PHP, and it is displayed on the web. When WebELMT provides a login web-page for the administrator, the administrator information should be input to the login form. In this case, the required administrator information is his/her ID and password. And when WebELMT provides a login page for the student, the student's required information is his/her ID and password. When the user is a new student, the user has to create a login account. To create an account, student name, first name, last name, username, e-mail, and a twice typed password are necessary.

Administrator

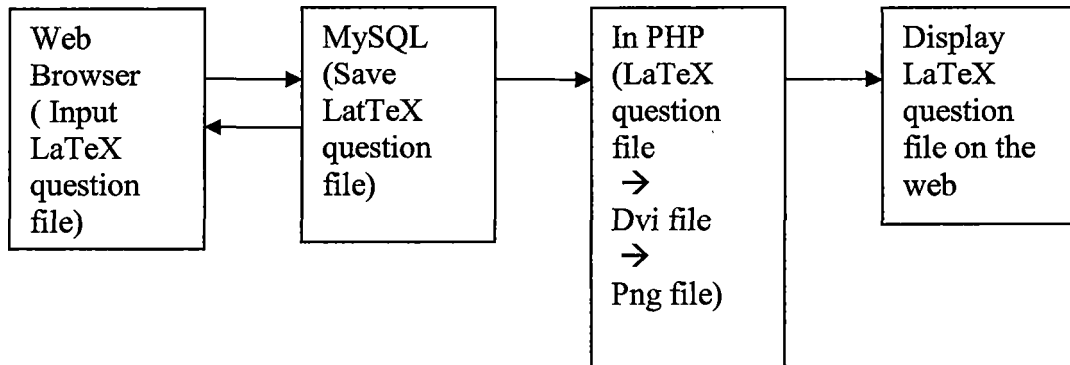


Figure 2.1 System Diagram for WebELMT

2.2.3 User Interface

The users of WebELMT are the system administrator and students. To access the system from internet, an ID and password are necessary. WebELMT provides the system administrator with three functions: the management of ELM tests, the management of ELM questions, and the management of student accounts. The management of ELM tests is as follows: creating test, editing test, and deleting test. The management of ELM questions also is similar to those of ELM test: creating question, editing question, and deleting question. The management of student accounts is as follows: adding account, deleting account.

Let's imagine a scenario using WebELMT. On the first ELM web-page, there are two separate login hyper-links: administrator and students. When they login in webELMT, an ID and password are necessary. If the ID and password are incorrect, they should input correct the ID and password. After the administrator login, the administrator can manage ELM tests, ELM questions, and student accounts. After student login, he/she can take an ELM test, get questions answer, and can see test scores.

2.2.4 Hardware Interface

Due to the complication of this project, using this project might be like peeking inside of someone's house or checking all of doors and windows without the owner's permission, this project is developed and tested within Computer Science Research Lab Network environment. Although a single machine is used for the development phase of this project, multiple machines are recommended when WebELMT is implemented in the production line. Table 2.1 is the hardware specification for the development phase.

Table 2.1. Hardware Specification for the Development
Phase

Hardware	Specification
Processor	1 GHz
Memory	512 MB
Storage	50 GB

2.2.5 Software Interface

To implement this project, secure web server, MySQL database servers are needed in the Linux operating system. Moreover, Photoshop, PHP, and LaTeX were used for developing dynamic web pages and graphics. In the development phase, older versions of software were used. Table 2.2 shows the Software Specification for the Development Phase.

Table 2.2. Software Specification for the Development Phase

Software	Specification
Operating System	Redhat Linux 7.1
Web Server	Apache 1.3.22
PHP	php 4.1.0
Database	Mysql 3.23
Graphics Editor	Adobe Photoshop 6.0

2.2.6 Memory Constraints

MySQL is known to be memory intensive software. Therefore, it is recommended for the Linux server to have

at least 512MB of memory in the system to run WebELMT effectively.

2.2.7 Operations

WebELMT will be maintained on the server based on x86 system. The server will need to be up 364 days a year allowing for one day of system maintenance.

2.2.8 Product Functions

In WebELMT, there are two separated users: system administrator and students. All functions are produced by the system administrator. The administrator's major functions of WebELMT are creating questions, modifying questions, deleting questions, creating tests, editing tests, deleting tests, adding student accounts, and deleting student accounts. Figure 2.2 shows the Administrator Use Case Diagram of WebELMT. The other user is a student. The student's needs are to get ELM information, take three major ELM tests, go through entire ELM tests, and check ELM test scores. Figure 2.3 shows Student Case Diagram of WebELMT.

2.2.8.1 Administrator Functions.

- **Create Question:** It is an important function of the system administrator. And it is a time-consuming task. Particularly, the system administrator sets up the LaTeX document system for the task. The administrator is responsible for the pleasing appearance of each ELM question on the web-browser. He has to create the question in large numbers to manage WebELMT. The questions are saved in a database. They can be retrieved for an ELM test.
- **Modify Questions:** The system administrator can modify the ELM questions. The administrator can recall the questions from the database and display them on the web-browser. There, the administrator can modify the questions, view and confirm the new versions and save them in the database.
- **Delete Question:** ELM questions are deleted by the administrator if the questions are not needed any longer. There are many reasons: the question is a duplicate, the question does not match the topic, the question is too easy or too difficult, or the

question is not effective any more. When the administrator deletes the question, it is removed from web-browser and database.

- **Create Test:** From many questions in the database, the administrator can create an entire ELM test. The ELM examination consists of 50 questions. The three categories are Numbers and Data, Algebra, and Geometry. The percentage of Numbers and Data is 35%, Algebra is 35%, and Geometry is 30%. The administrator can choose the questions from three categories within the given percentages.
- **Edit Test:** The administrator can edit an ELM test by editing in a new question or editing out an old question. If the test does not match the category percentage, the test will be edited by the administrator.
- **Delete Test:** This case does not happen often. Often if the administrator thinks that the test is not effective or not interesting any more, the administrator can delete the entire ELM test. But the administrator is more likely to edit a test than to delete it.

- **Create Student Account:** The administrator can create a student account by student ID. The student ID is saved in the database. When a student creates a WebELMT login, he/she input his/her ID, password, other information, and he/she can login to WebELMT.
- **Delete Student Account:** There are many reasons that an account can be deleted by the administrator. One of these reasons is that a student graduated from the university or a student does not need his/her account anymore. In this case, the system administrator discovers that the student's account has not been accessed for a long time and decides to delete it. For some other reason, if the account has not been accessed for a certain period of time, the system administrator will decide on whether to delete this account or not.

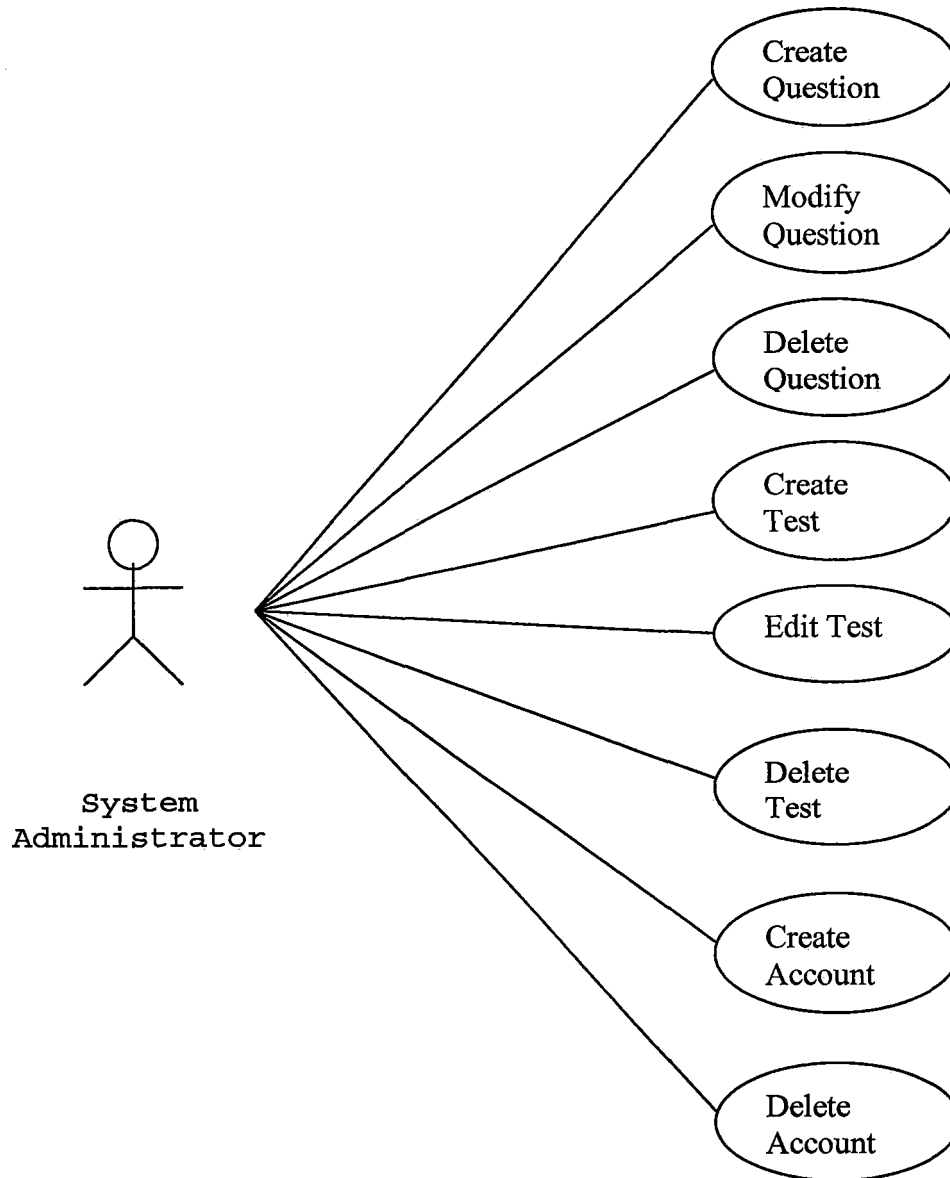


Figure 2.2 Administrator Use Case Diagram

2.2.8.2 Student Function.

- Get ELM Test Information: Students can get the ELM test information on WebELMT, which includes the purpose of the ELM test, exemption of the ELM test, the ELM test description, content, timing, topics on the ELM test, and sample questions of the ELM test.
- Take Three Major ELM Tests: On WebELMT, students can take three major types of ELM tests. The topics of these are Numbers and Data, Algebra, and Geometry. Students can practice their weak category test several times. And students can confirm the answer of the question immediately. Through practice, their ability of solving the ELM test will be increased.
- Take Timed ELM Test: Timed ELM Test is a 90 minutes timed-setting ELM test. Students should finish the ELM test in 90 minutes. If not, the ELM test will be terminated. In order to finish the ELM test in 90 minutes, students must practice ELM test several times. Students can

practice untimed ELM test before taking timed ELM test.

- Take UnTimed ELM Test: Untimed ELM test is an ELM test without time limitation. So, students can practice the ELM test without restriction. Timed ELM tests and Untimed ELM tests are of the same degree of difficulty, and have the same number of questions.
- Check ELM Test Score: Students can check the score and answers of their ELM test. They can view their score history of previous taken timed and untimed ELM tests.

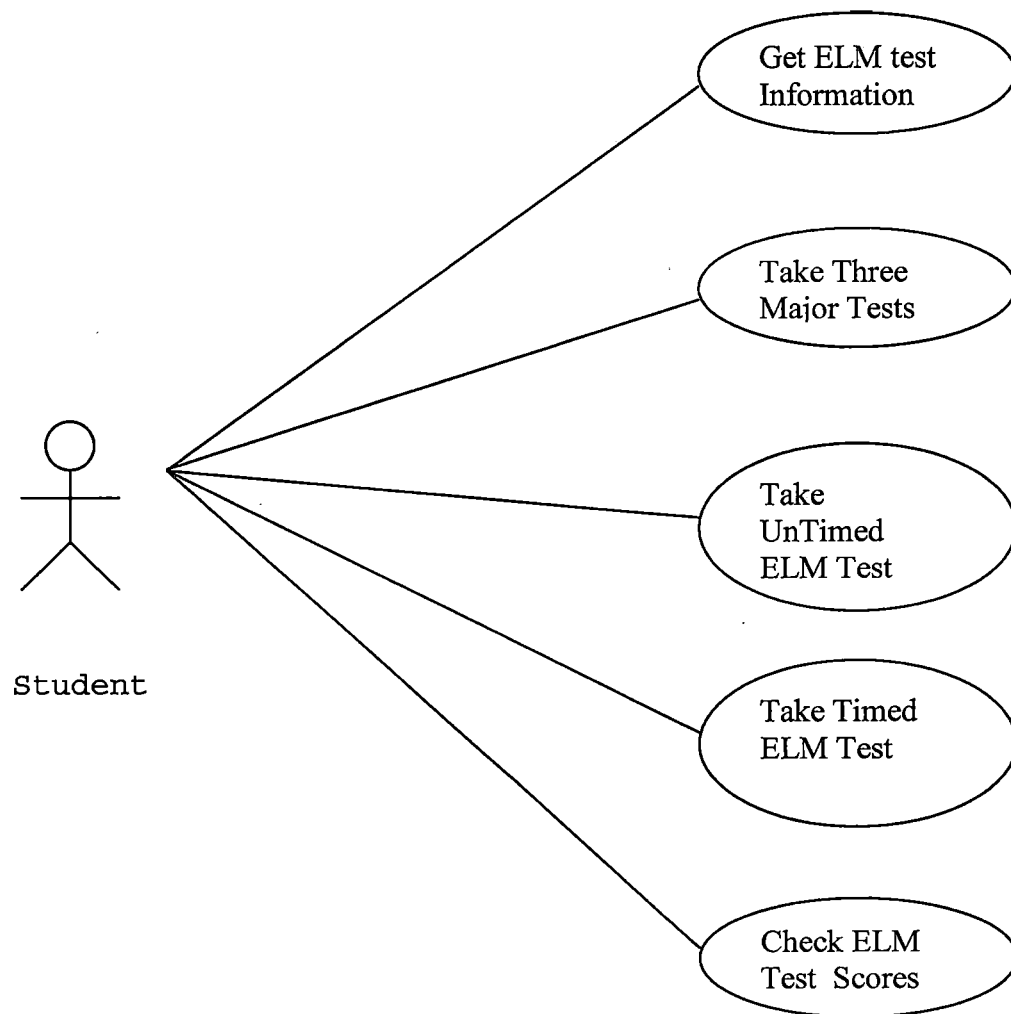


Figure 2.3 Student Use Case Diagram

2.2.9 User Characteristics

Since WebELMT is an ELM test system, the intended users of the WebELMT are a system administrator and

students. The access to WebELMT system by other persons must be prevented for security reasons. The system administrator will need to have substantial knowledge in PHP Programming and in addition will need to have a fluent knowledge of the LaTeX document system and be able to read and understand system events.

2.2.10 Assumptions and Dependencies

This system is being implemented on a Linux operating system using a MySQL database. Since the program is coded entirely in PHP, any platform with PHP installed, a PHP compatible web server, and a SQL compatible relational database can conceivably, with small modifications, run the WebELMT program.

2.3 Software Specific Requirements

2.3.1 External Interface

This section describes all detailed inputs and outputs of WebELMT.

- Home. This is the first page of WebELMT. (See Figure 2.4). This page is separated into two users: the administrator and student. The administrator and student can access separately.

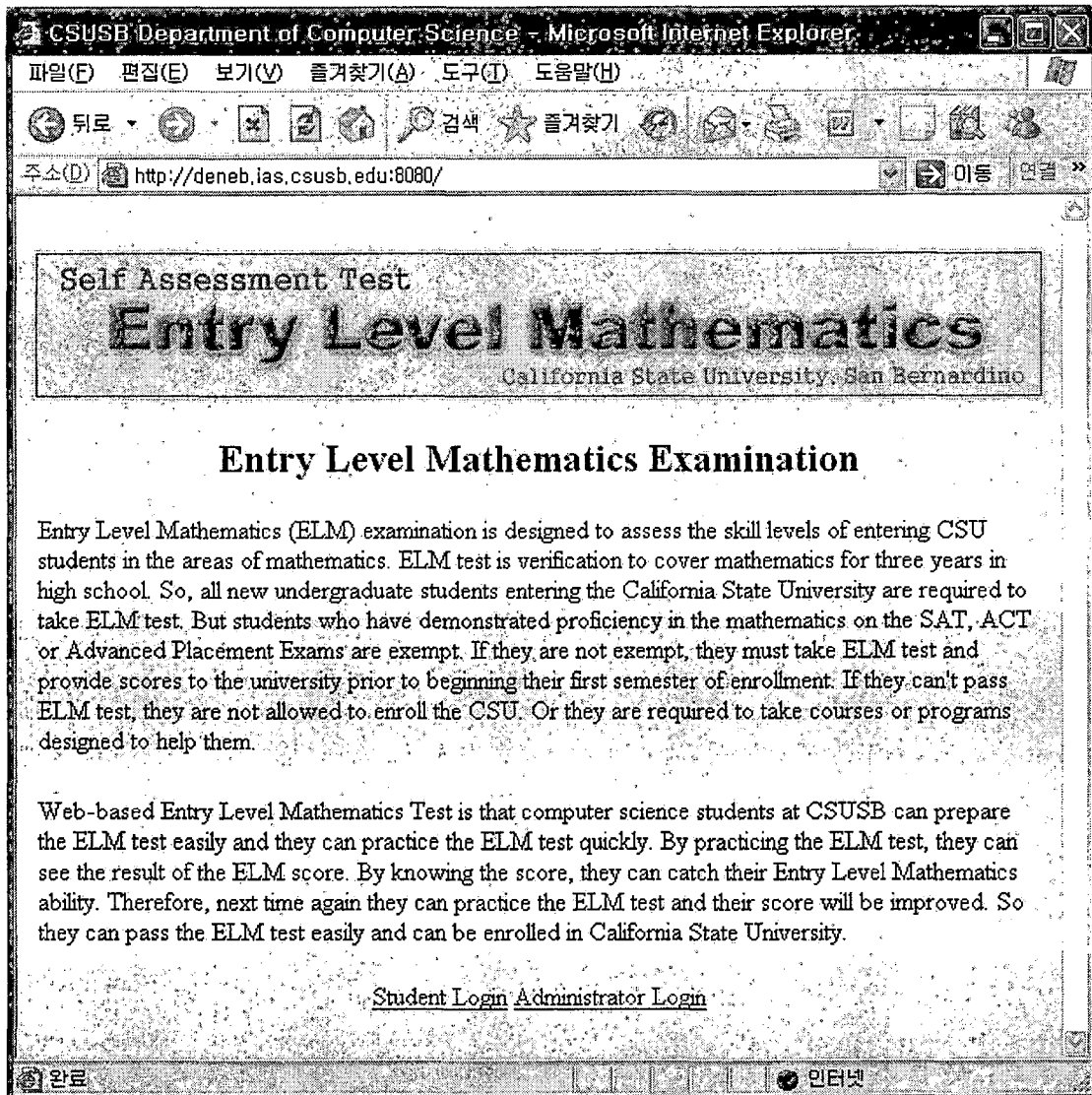


Figure 2.4 Home Page.

- Administrator Login Page. Administrator pages of WebELMT are accessed through this login page.

The administrator provides his/her login ID and password to access WebELMT.

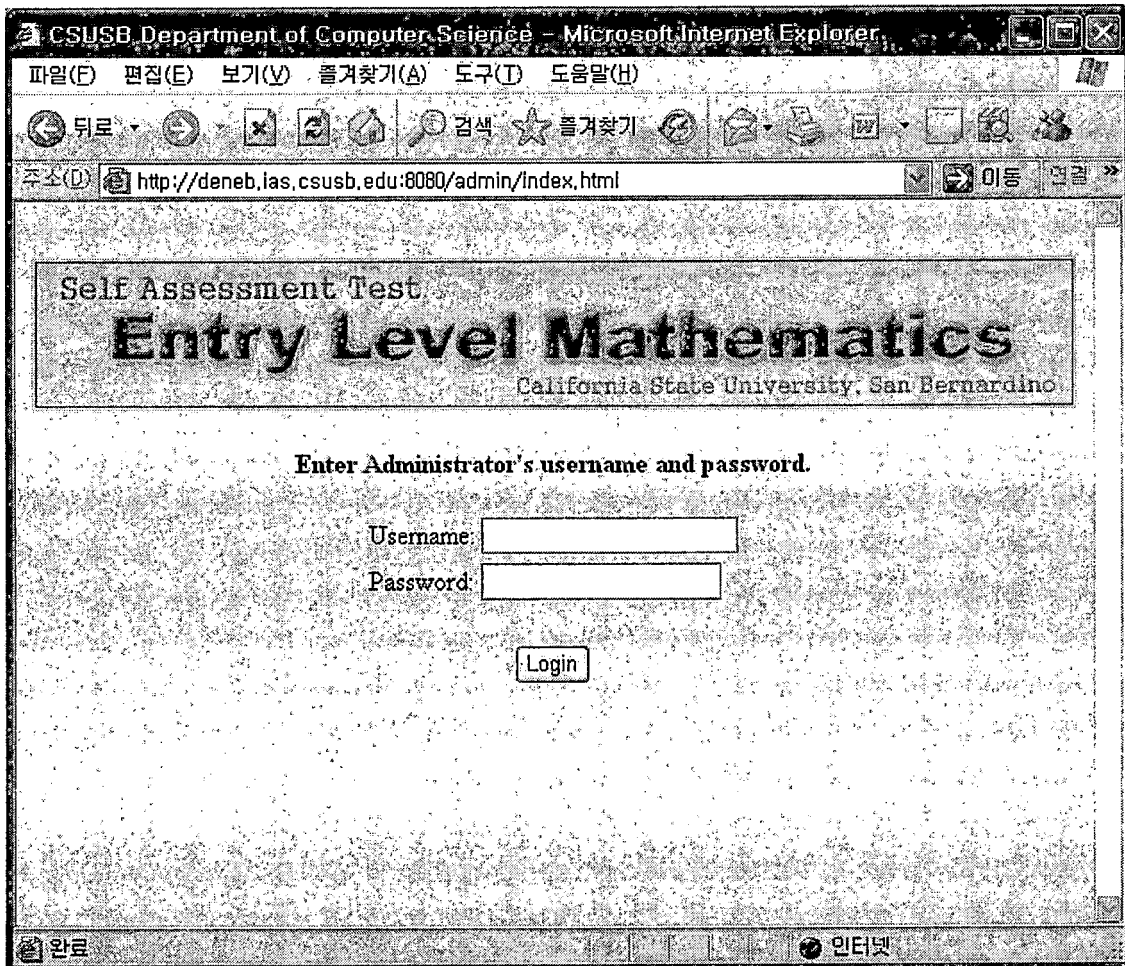


Figure 2.5 Administrator Login Page

- Administrator Menu Page. This page is menu page for administrator. This page provides display numbers and data questions, algebra questions,

geometry questions, and check students' ELM test scores.

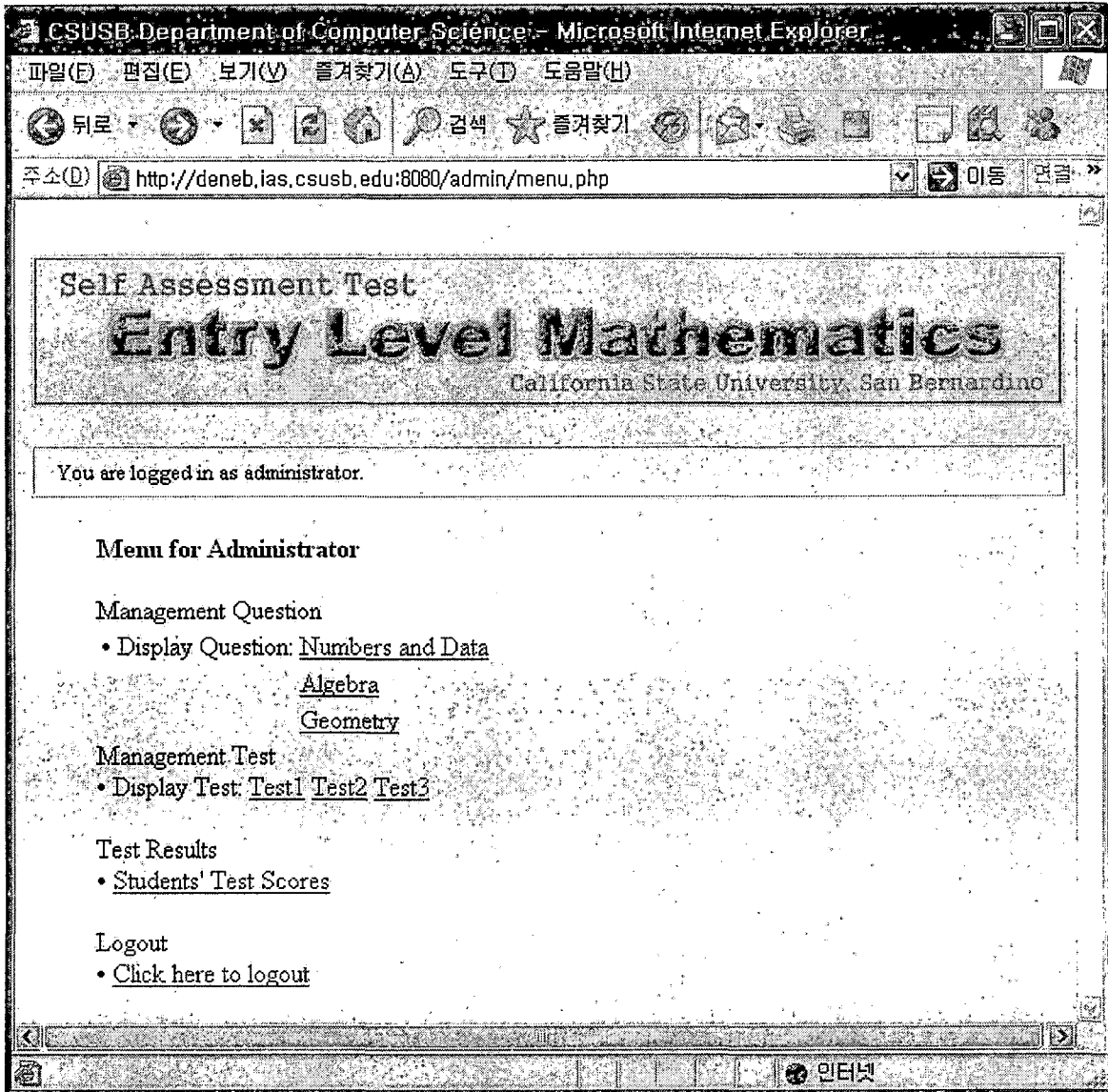


Figure 2.6 Administrator Menu Page

- Display Numbers and Data Question List Page. This page shows display numbers and data questions list. In this page, there are 50 questions on numbers and data.

CSUSB Department of Computer Science - Microsoft Internet Explorer

파일(F) 편집(E) 보기(V) 즐겨찾기(A) 도구(T) 도움말(H)

주소(D) http://deneb.ias.csusb.edu:8080/admin/displaylist_numdata_tex.php

Self Assessment Test

Entry Level Mathematics

California State University, San Bernardino

You are logged in as administrator.

Number and Data List

num	answer	level	topic
1	A	low	Carry out basic arithmetic calculations
2	A	med	Carry out basic arithmetic calculations
3	B	med	Understand and use percent in context
4	B	high	Understand and use percent in context
5	B	low	Understand and use percent in context
6	B	med	Understand and use percent in context
7	C	med	Interpret and use ratio and proportion in context
8	C	med	Interpret and use ratio and proportion in context
9	D	low	Use estimation appropriately
10	D	med	Use estimation appropriately
11	A	low	Evaluate and estimate square roots
12	A	med	Evaluate and estimate square roots
13	A	med	Evaluate and estimate square roots
14	B	med	Calculate and understand the arithmetic mean

완료 인터넷

Figure 2.7 Display Numbers and Data Question List Page

-
- CSUSB Department of Computer Science - Microsoft Internet Explorer
- 파일(F) 편집(E) 보기(V) 즐겨찾기(A) 도구(T) 도움말(H)
- 뒤로 ◀ ▶ 앞으로 ✕ 새로고침 🏠 검색 ☆ 즐겨찾기 ⌂ ☰
- 주소(D) http://deneb.las.csusb.edu:8080/admin/display_numdata_tex.php?num=1 이동 연결 >>
- ## Self Assessment Test Entry Level Mathematics
- California State University, San Bernardino
- You are logged in as administrator.
- ### Numbers and Data Question
- A big lecture room has 24 rows, each with 12 seats. At a certain class there were, on average, 9 empty seats per row. What was the attendance at that class?*
- (A) 216 (B) 264 (C) 297 (D) 300 (E) 375
- | | |
|------------------|---|
| question number: | 1 |
| answer: | A |
| level: | low |
| topic: | Carry out basic arithmetic calculations |
- Create Modify Delete List Menu Page
- 완료 인터넷

25

- Create Numbers and Data Question Page. In this page, the administrator can create a numbers and data question. The administrator should type the question in LaTeX form. The important thing is that the question number is created automatically as the one succeeding the number of the most recent question.

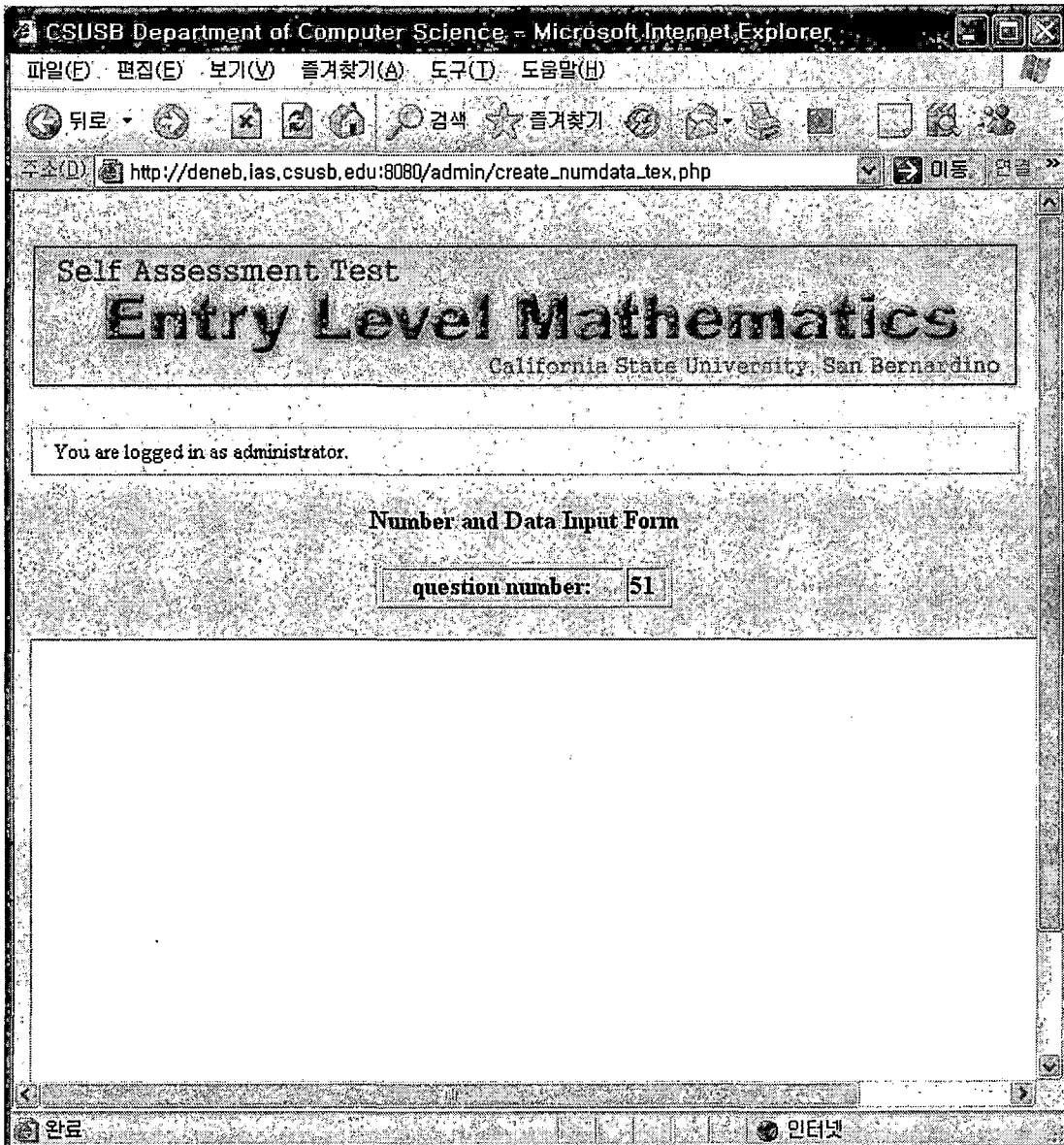


Figure 2.9 Create Numbers and Data Question Page

- Modify Numbers and Data Question Page. On this page, the administrator can modify a numbers and data question.

CSUSB Department of Computer Science - Microsoft Internet Explorer

파일(F) 편집(E) 보기(V) 즐겨찾기(A) 도구(T) 도움말(H)

뒤로 앞으로 검색 즐겨찾기 이동 연결

주소(D) http://deneb.las.csusb.edu:8080/admin/modifyForm_numdata_tex.php?num=1

Numbers and Data Modify Form

Question number: 1

```
[tex]
\begin{displaymath}
\begin{document}

\[\emph{A big lecture room has 24 rows,each with 12 seats. At a certain class t
were,}\]

\[\emph{on average, 3 empty seats per row. What was the attendance at that clas
}\[\emph { (A) 216 (B) 264 (C) 297 (D) 300 (E) 375}\]}

\end{document}
\end{displaymath}
[/tex]
```

answer: A

level: low

topic: Carry out basic arithmetic calculations

완료 인터넷

Figure 2.10 Modify Numbers and Data Question Page

- Display Algebra Question List Page. This page shows the display of the algebra question list. On this page, there are many questions of algebra.

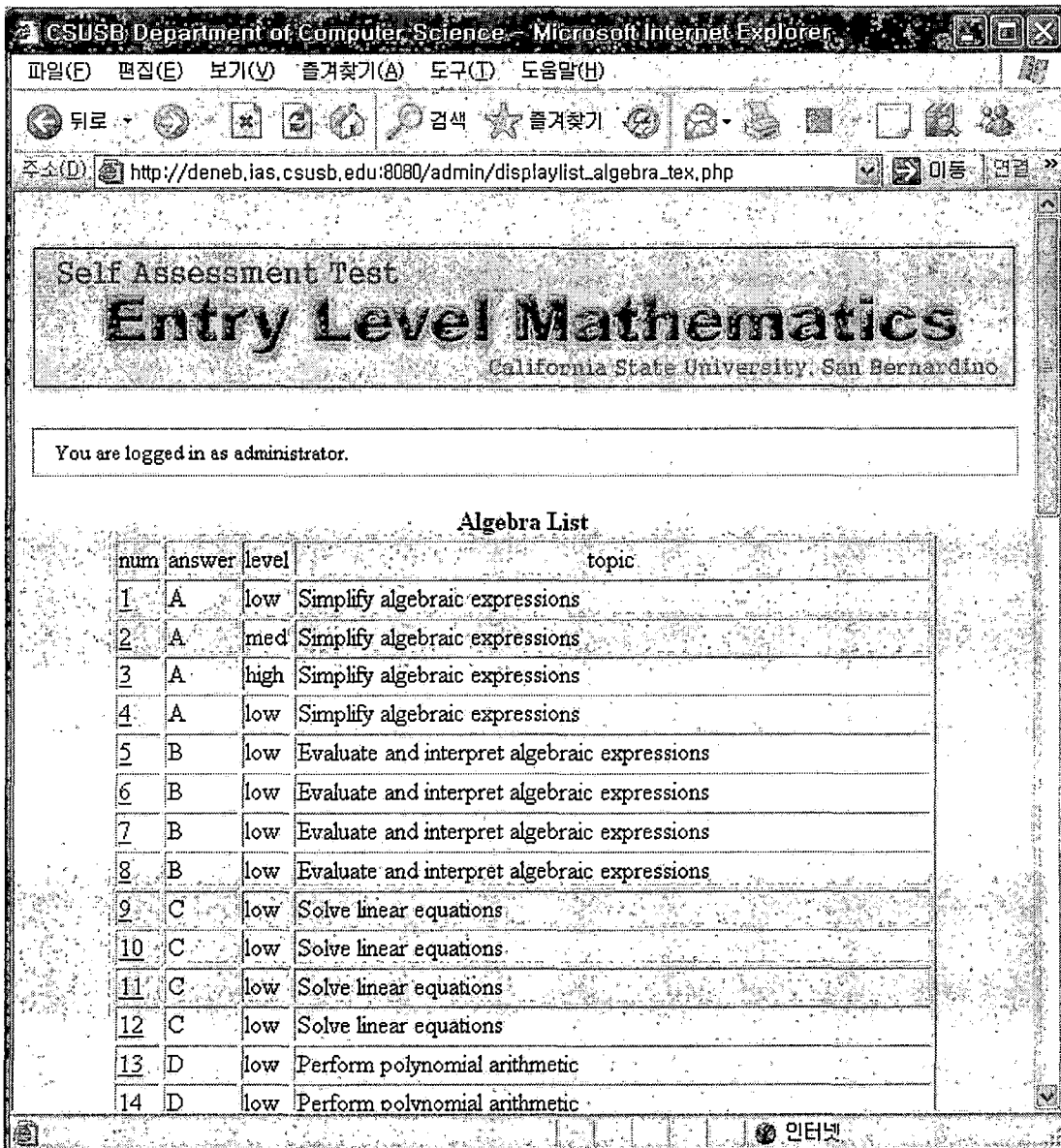


Figure 2.11 Display Algebra Question List Page

- Display Algebra Question Page. This page displays an algebra question. The question is displayed in LaTeX form.

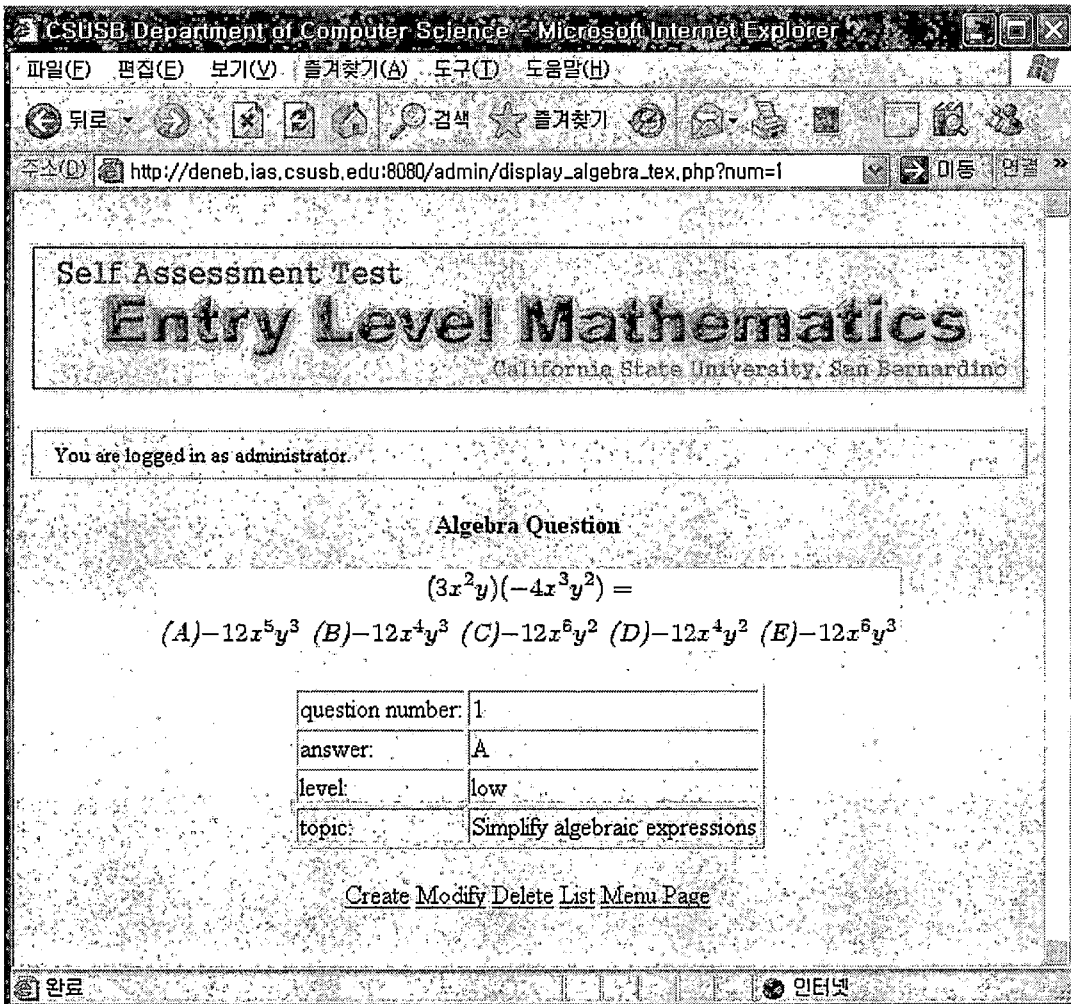


Figure 2.12 Display Algebra Question Page

- Create Algebra Question Page. In this page, the administrator can create an algebra question. The

administrator should type the question in LaTeX form. Again the question number is created automatically from the last number.

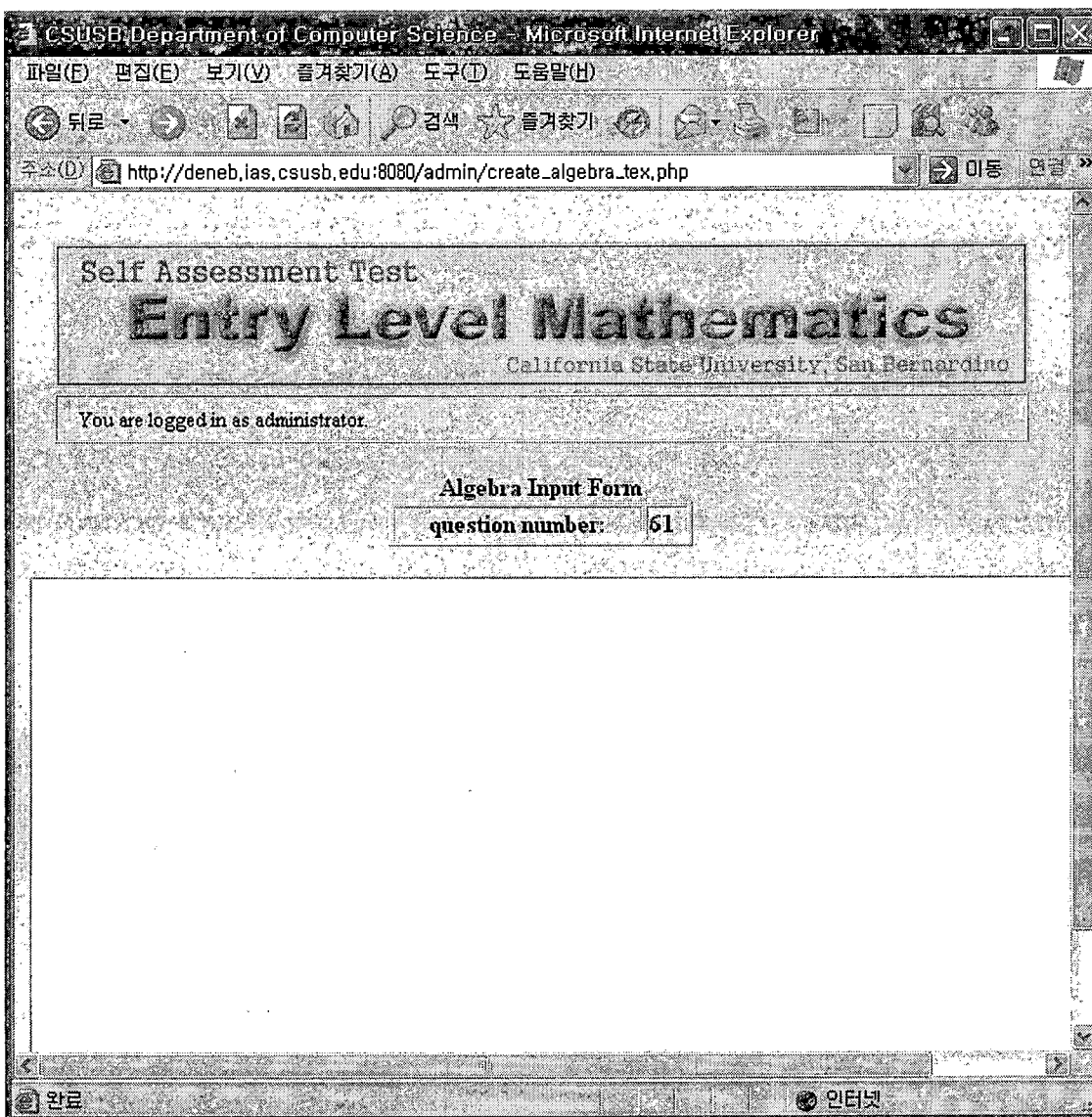


Figure 2.13 Create Algebra Question Page

- Modify Algebra Question Page. In this page, the administrator can modify an algebra question.

Algebra Modify Form

Question number:

```
[tex]
\begin{displaymath}
\begin{document}
\[(3x^2y)(-4x^3y^2) = \]
\[\emph{(A)} \{(-12x^5y^3)\} \text{ (B)} \{(-12x^4y^3)\} \text{ (C)} \{(-12x^6y^2)\} \text{ (D)} \{(-12x^4y^2)\} \text{ (E)}
12x^6y^3\} \} \]
\end{document}
\end{displaymath}
[/tex]
```

Simplify algebraic expressions

- Evaluate and interpret algebraic expressions
- Simplify algebraic expressions
- Express relationships among quantities using variables
- Use properties of exponents
- Perform polynomial arithmetic
- Perform arithmetic operations involving rational expressions
- Solve linear equations
- Solve systems of linear equations in two unknowns
- Solve linear inequalities
- Solve problems in context that are modeled by linear equations
- Solve quadratic and rational equations: real solution only
- Solve problems in context that are modeled by quadratic equations
- Solve equations involving absolute value (in one variable)
- Solve inequalities involving absolute value (in one variable)
- Find and use slopes and intercepts of lines
- Use constant and average rates to solve problems in context

answer:

level:

topic:

Figure 2.14. Modify Algebra Question Page.

- Display Geometry Question List Page. This page displays the geometry question list. On this page, there are 50 questions of geometry.

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주소(D) http://deneb.ias.csusb.edu:8080/admin/displaylist_geometry_tex.php

You are logged in as administrator.

Geometry List

num	answer	level	topic
1	A	low	Determine angles in the plane
2	A	low	Determine angles in the plane
3	B	med	Use properties of congruent or similar geometric object
4	B	low	Use properties of congruent or similar geometric object
5	C	low	Graph linear functions in one variable
6	D	low	Plot points on the graph of a function determined by an algebraic expression
7	D	low	Plot points on the graph of a function determined by an algebraic expression
8	E	med	Find the perimeter, area, or volume of geometric figures
9	E	high	Find the perimeter, area, or volume of geometric figures
10	E	low	Find the perimeter, area, or volume of geometric figures
11	A	med	Find the length or midpoint of a line segment in the coordinate plane
12	A	med	Find the length or midpoint of a line segment in the coordinate plane
13	B	low	Use the Pythagorean Theorem
14	B	low	Use the Pythagorean Theorem
15	C	low	Graph linear functions in one variable
16	C	med	Identify and plot points on the number line
17	C	low	Identify and plot points on the number line
18	D	med	Identify and plot points in the coordinate plane
19	D	low	Identify and plot points in the coordinate plane

인터넷

Figure 2.15 Display Geometry Question List Page

- Display Geometry Question Page. This page shows a geometry question. The question is displayed in LaTeX form.

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주소(D) http://deneb.las.csusb.edu:8080/admin/display_geometry_tex.php?num=1

Self Assessment Test

Entry Level Mathematics

California State University, San Bernardino

You are logged in as administrator.

Geometry Question

In the figure below, p is parallel to q and $y = 119$. What is the value of x ?

(A) 61 (B) 45 (C) 59 (D) 60 (E) 120

question number:	1
answer:	A
level:	low
topic:	Determine angles in the plane

Create Modify Delete List Menu Page

완료 인터넷

Figure 2.16. Display Geometry Question Page.

- Create Geometry Question Page. On this page, the administrator can create a geometry question.

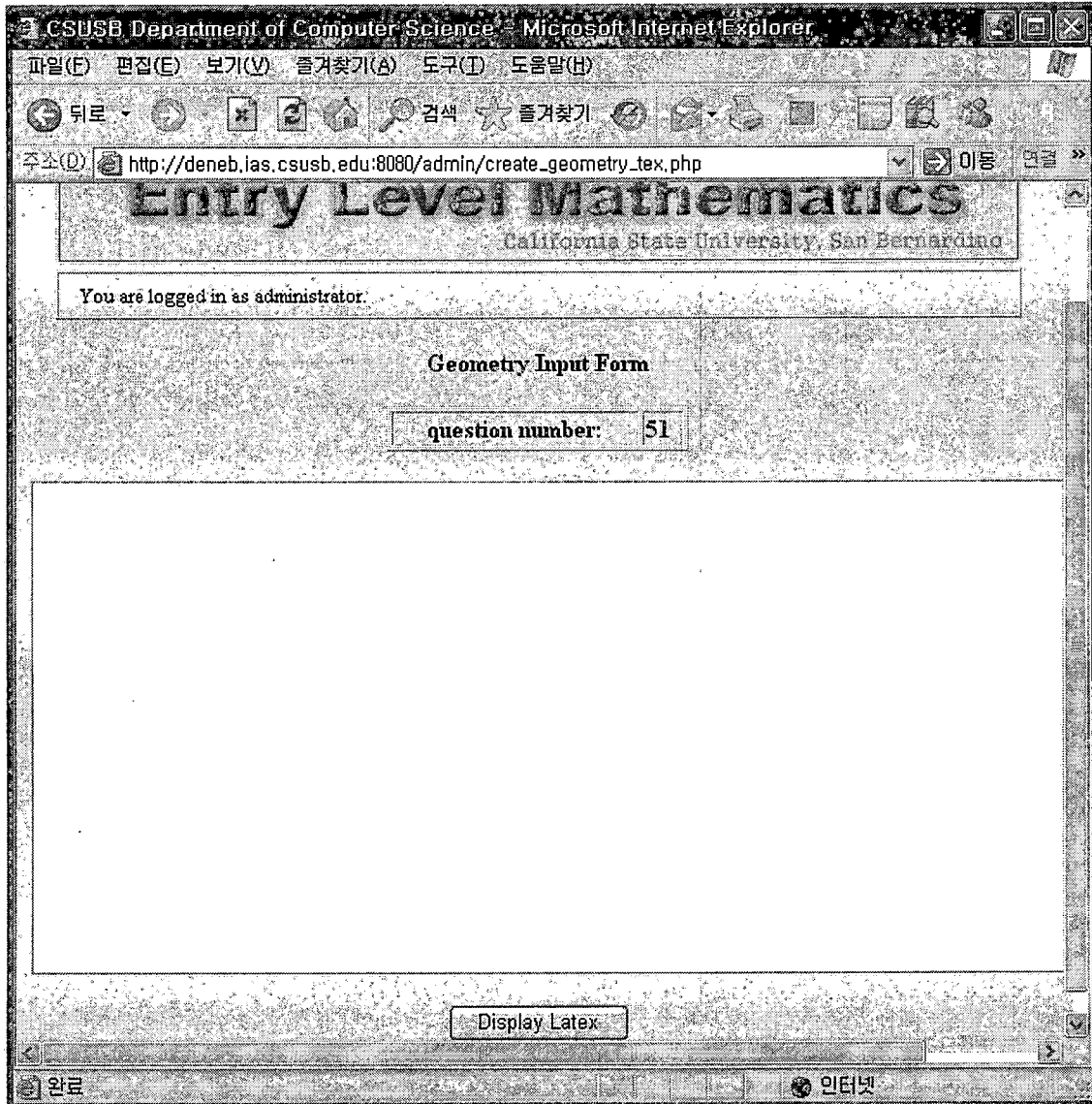


Figure 2.17 Create Geometry Question Page

- Modify Geometry Question Page. On this page, the administrator can modify a geometry question. The administrator should modify the question in LaTeX form.

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뒤로 () 검색 ☆ 즐겨찾기 () 이동 연결 >>

주소(D) http://deneb.las.csusb.edu:8080/admin/modifyForm_geometry_tex.php?num=1

Geometry Modify Form

Question number: 1

```
[tex]
\begin{displaymath}
\begin{document}
\[\emph{ In the figure below, p is parallel to q and y = 119. What is the value of }
\begin{picture}

\put(130,50){\line(1,0){90}}
\put(130,30){\line(1,0){90}}
\put(150,10){\line(1,2){40}}
\put(125,50){p}
\put(125,30){q}
\put(160,20){y^{\circ}}
\put(10,35){x^{\circ}}

\end{picture}
\[\emph{ (A) 61 (B) 45 (C) 53 (D) 60 (E) 120 }}\]
\end{document}
\end{displaymath}
[/tex]
```

answer: A

level: low

topic: low med high

완료 인터넷

Figure 2.18 Modify Geometry Question Page

- Display All Students ELM Score. In this page, the administrator can view the result of all students' ELM scores.

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주소(D) http://deneb.las.csusb.edu:8080/admin/score.php?sort=s_id&dir=asc

Self Assessment Test

Entry Level Mathematics

California State University, San Bernardino

You are logged in as administrator.

S_id	id	no time test1	no time test2	no time test3	time test1	time test2	time test3
111-11-1111	obaek	1	48	46	0	0	0
222-22-2222	jyang	45	46	47	47	48	49
333-33-3333	syang	42	43	42	45	46	47
444-44-4444	dkim	25	27	30	31	32	34
555-55-5555	jlee	32	33	35	35	36	37
666-66-6666	djang	35	36	39	35	34	38
777-77-7777	rt						

[Menu Page](#)

Figure 2.19 All Students ELM Test Score Page

- Student Login Page. All student pages of WebELMT are accessed through this login page. The student

provides his/her login ID and password to access WebELMT. When the student provides the correct login ID and password, this page authorizes the student and creates a new session. If the student is a new student, he/she must create a new account.

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주소(D) http://deneb.las.csusb.edu:8080/login.php

Self Assessment Test

Entry Level Mathematics

California State University, San Bernardino

Enter your username and password to take the ELM test.

Username:

Password:

If you don't have an account for the ELM test, [create account](#) first.

완료 인터넷

Figure 2.20 Student Login Page

- Create New Student Account Page. If the student is a new student, he/she must create a new account. He/She provides his/her student number, first name, last name, username, password, and e-mail. Particularly, he/she should confirm the password by typing it twice. If his/her account is accepted, he/she can revisit the student login page. There, he/she must input his/her username and password.

The screenshot shows a Microsoft Internet Explorer window with the title 'CSUSB Department of Computer Science - Microsoft Internet Explorer'. The address bar displays 'http://deneb.ias.csusb.edu:8080/create_form.php'. The main content area features a header with 'Self Assessment Test' and 'Entry Level Mathematics' in large, bold letters, with 'California State University, San Bernardino' below it. The page is titled 'New User Account Creation Page'. It contains several input fields for user registration: 'Student Number:', 'First Name:', 'Last Name:', 'Username:', 'Password:', 'Confirm Password:', and 'E-mail:'. Each label is followed by a text input box. At the bottom of the form is a button labeled 'Create Account'. The browser's status bar at the bottom shows '완료' (Complete) and '인터넷' (Internet).

Figure 2.21 Create New Student Account Page

- Student Login Accept Page. This page is the student login accepted page. Here, student can go to the student menu page by clicking.

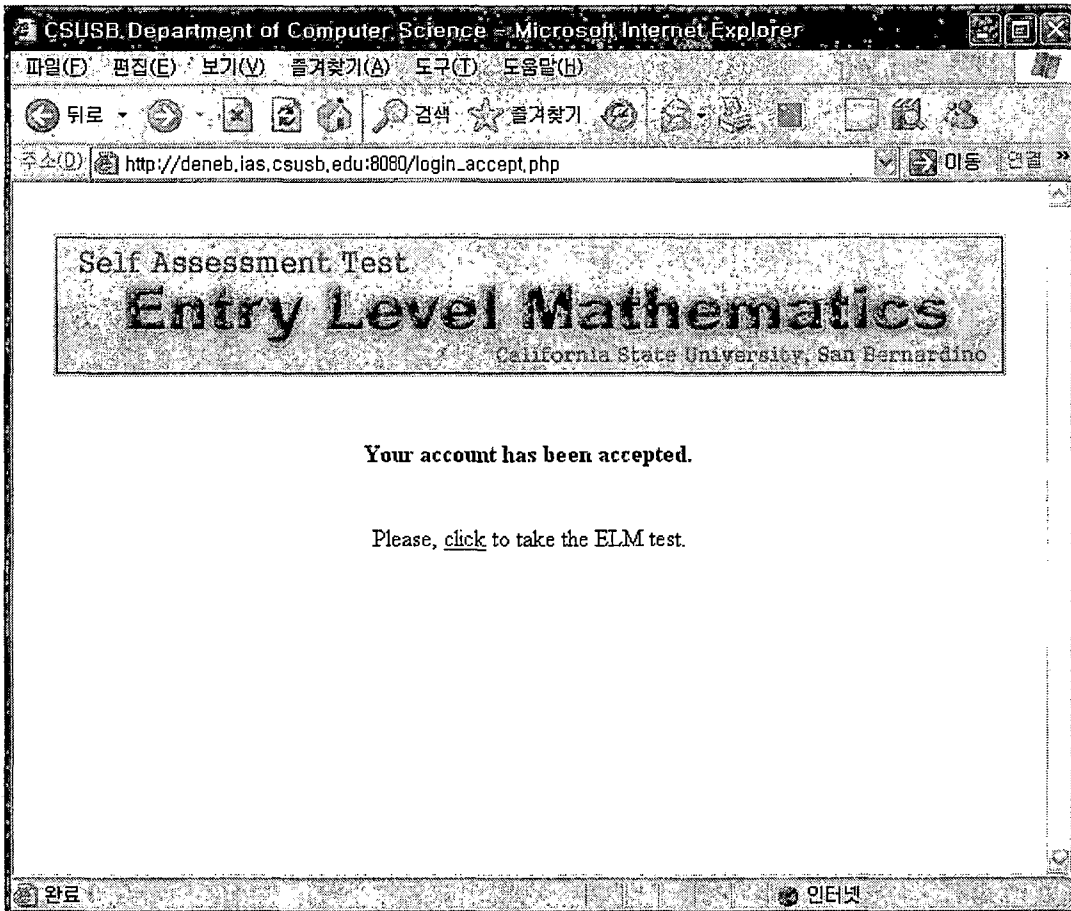


Figure 2.22 Student Login Accept Page.

- Student Menu Page. On this page, the student can get the ELM test information, take three major tests, take untimed ELM tests, and take timed ELM tests. In addition he/she can check his/her ELM test scores.

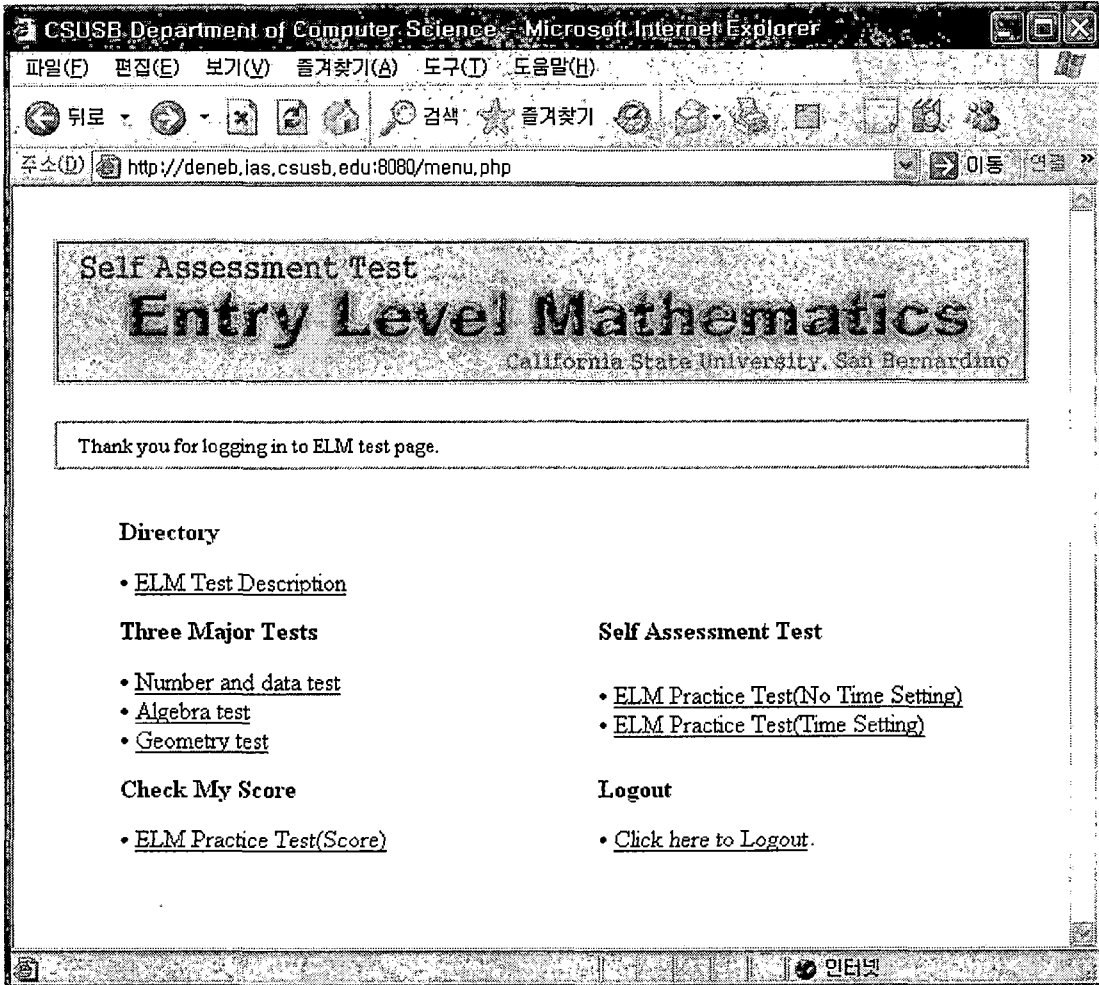


Figure 2.23 Student Menu Page

- ELM Description Web-Page. On this Web-page, the student gets all information about the ELM exam: Questions and Answers about the ELM test, topics

of the ELM test, Contents of the ELM test, timing of the ELM test, and sample questions.

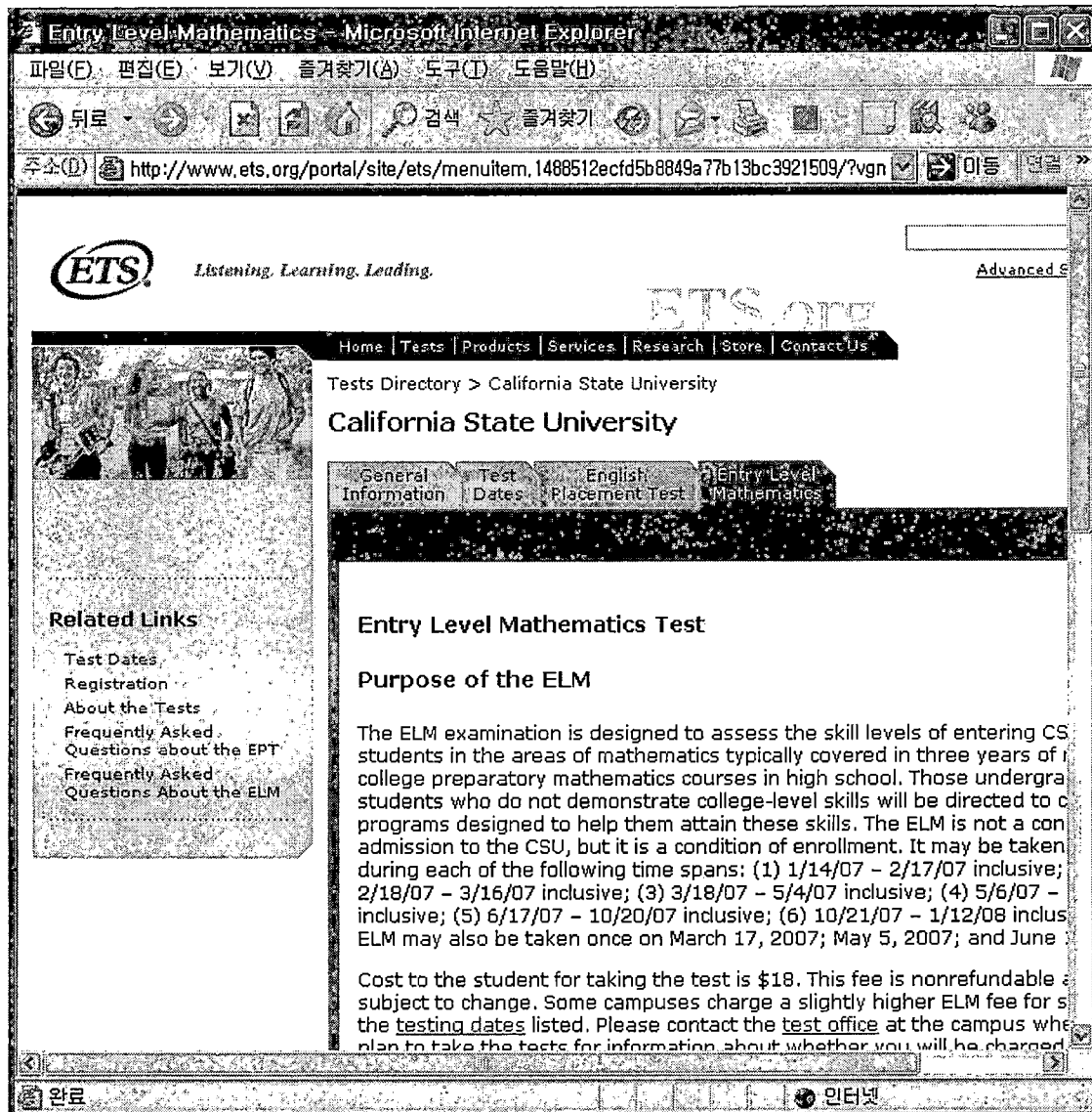


Figure 2.24. ELM Description Page.

- Practice Page for Numbers and Data Question. On this page, the student can practice numbers and data questions. He/She can click the Check Answer button for the correct answer. If his/her answer is correct, a message of correct is displayed. If it is not correct, a message of the incorrect answer is displayed. Therefore he/she can get the correct answer for the question. And he/she can click the Next Question button for the next question. A randomly selected next question is displayed.

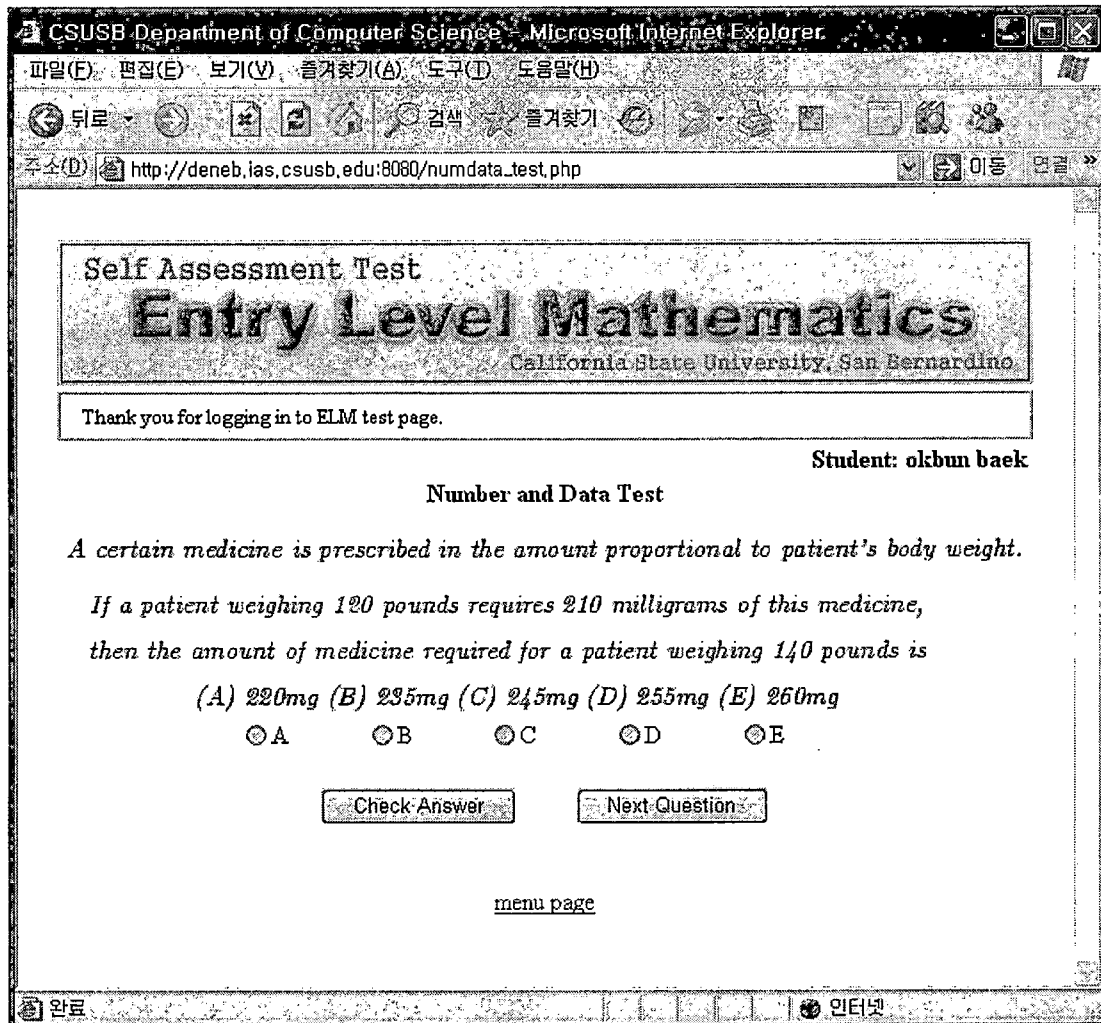


Figure 2.25 Practice Page for Numbers and Data Question

- Practice Page for Algebra Question. On this page, the student can practice algebra questions. He/She can click the Check Answer button for correct answer.

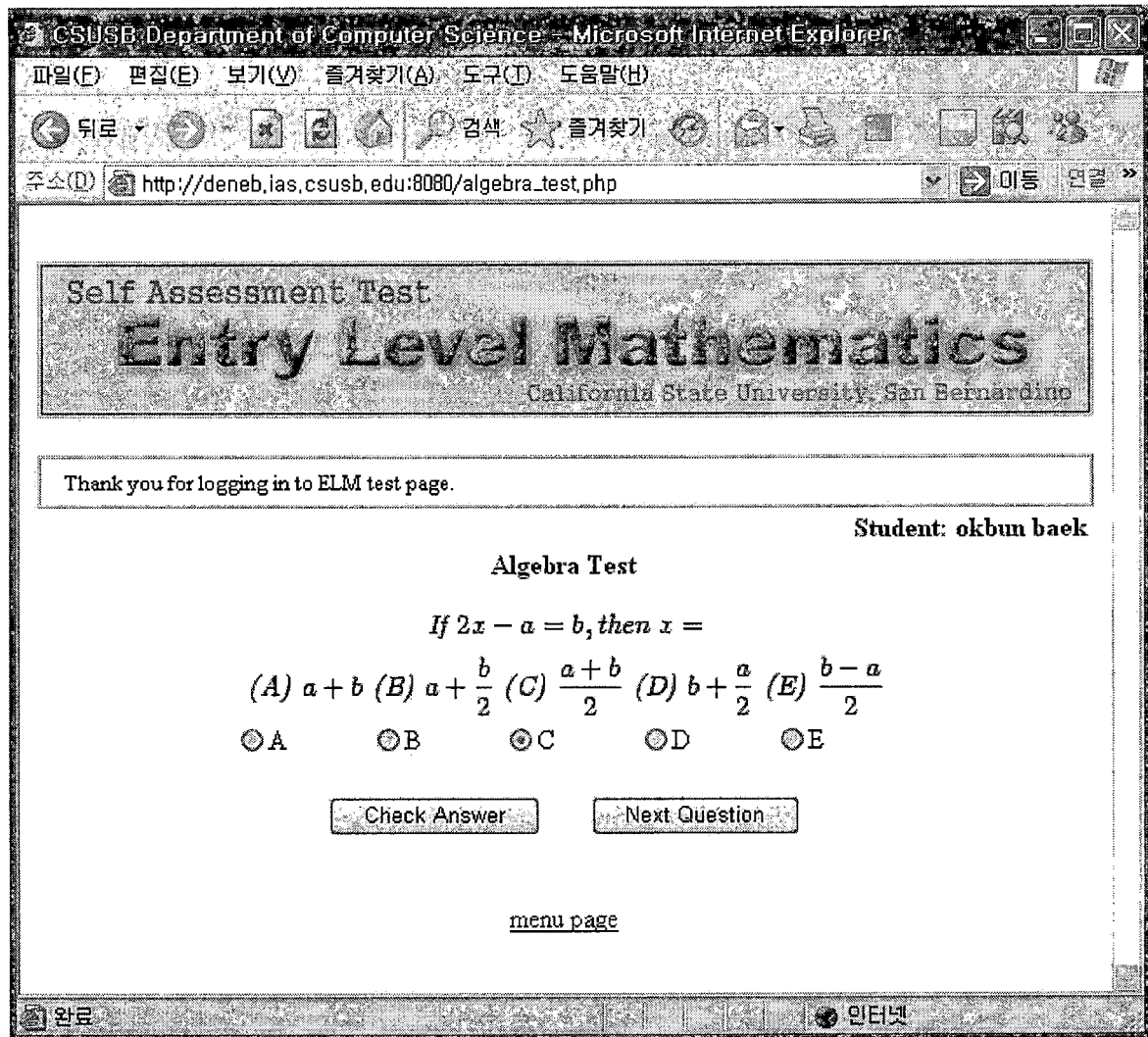


Figure 2.26 Practice Page for Algebra Question

- Practice Page for Geometry Question. On this page, the student can practice geometry questions.

He/She can click the Check Answer button for correct answer.

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주소 http://deneb.las.csusb.edu:8080/geometry_test.php

Self Assessment Test

Entry Level Mathematics

California State University, San Bernardino

Thank you for logging in to ELM test page.

Student: okbun baek

Geometry Test

In quadrilateral $ABCD$, BC is parallel to AD and BA is perpendicular to AD . If $BC = 8$, $AD = 12$, and $ABCD$ has area equal to 30, then what is CD ?

(A) 3 (B) 4 (C) 6 (D) 25 (E) 5

☐ A ☐ B ☐ C ☐ D ☐ E

Check Answer Next Question

완료 인터넷

Figure 2.27 Practice Page for Geometry Question

- UnTimed ELM Test List Page. On this page, the student can take three untimed ELM tests. By clicking, he/she can go to the actual test page.

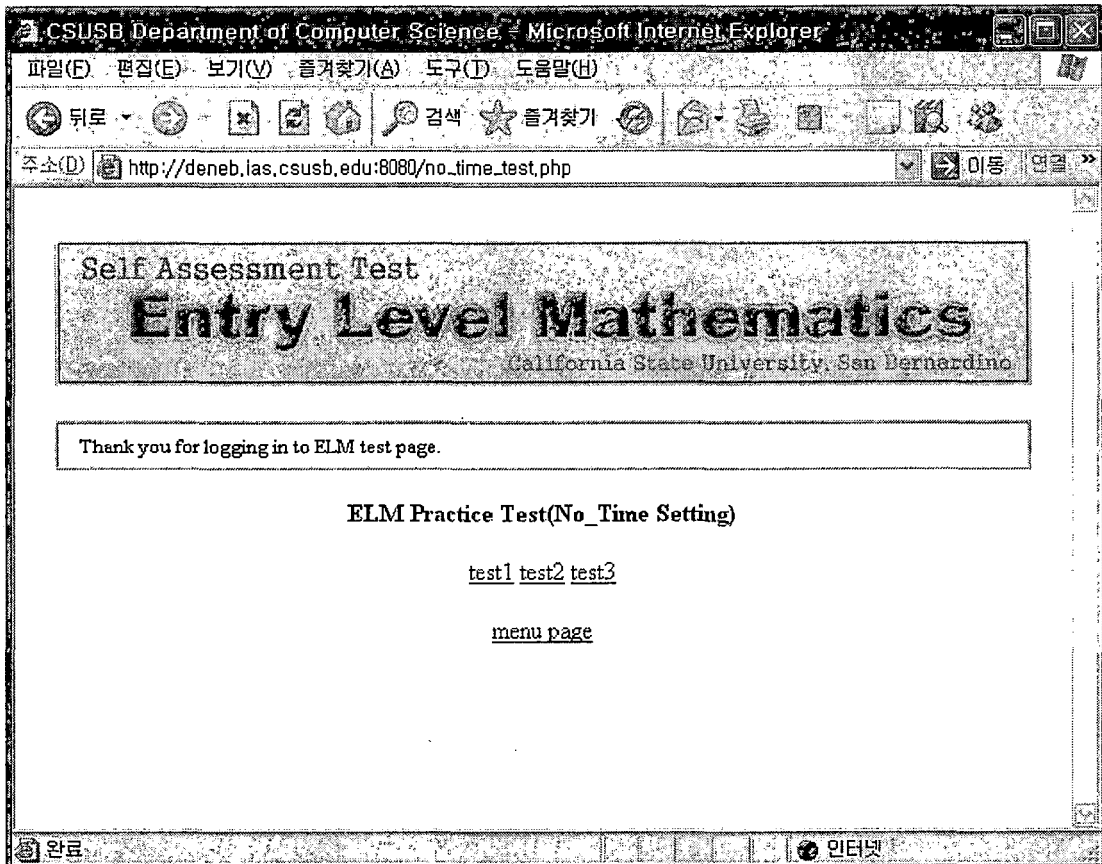


Figure 2.28 UnTimed ELM Test List Page

- UnTimed ELM Test1 Page. On this page, the student can take untimed ELM test1. ELM test1 consists of 50 questions. If the student is done, he/she

clicks the Submit button. On the next page, he/she can check scores and answers.

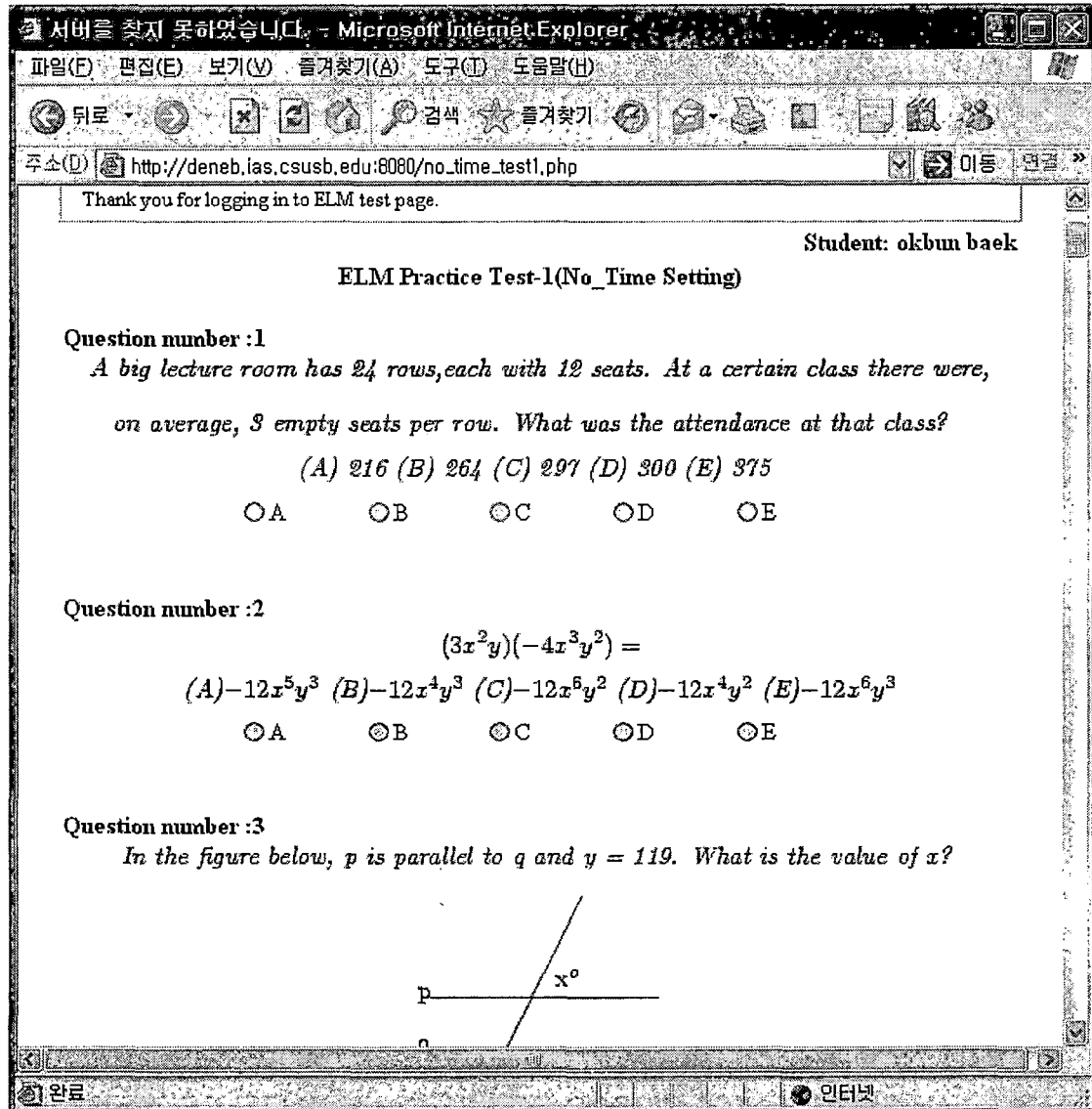


Figure 2.29 UnTimed ELM Test1 Page

- UnTimed ELM Test2 Page. On this page, the student can take untimed ELM test2. ELM test2 consists of 50 questions.

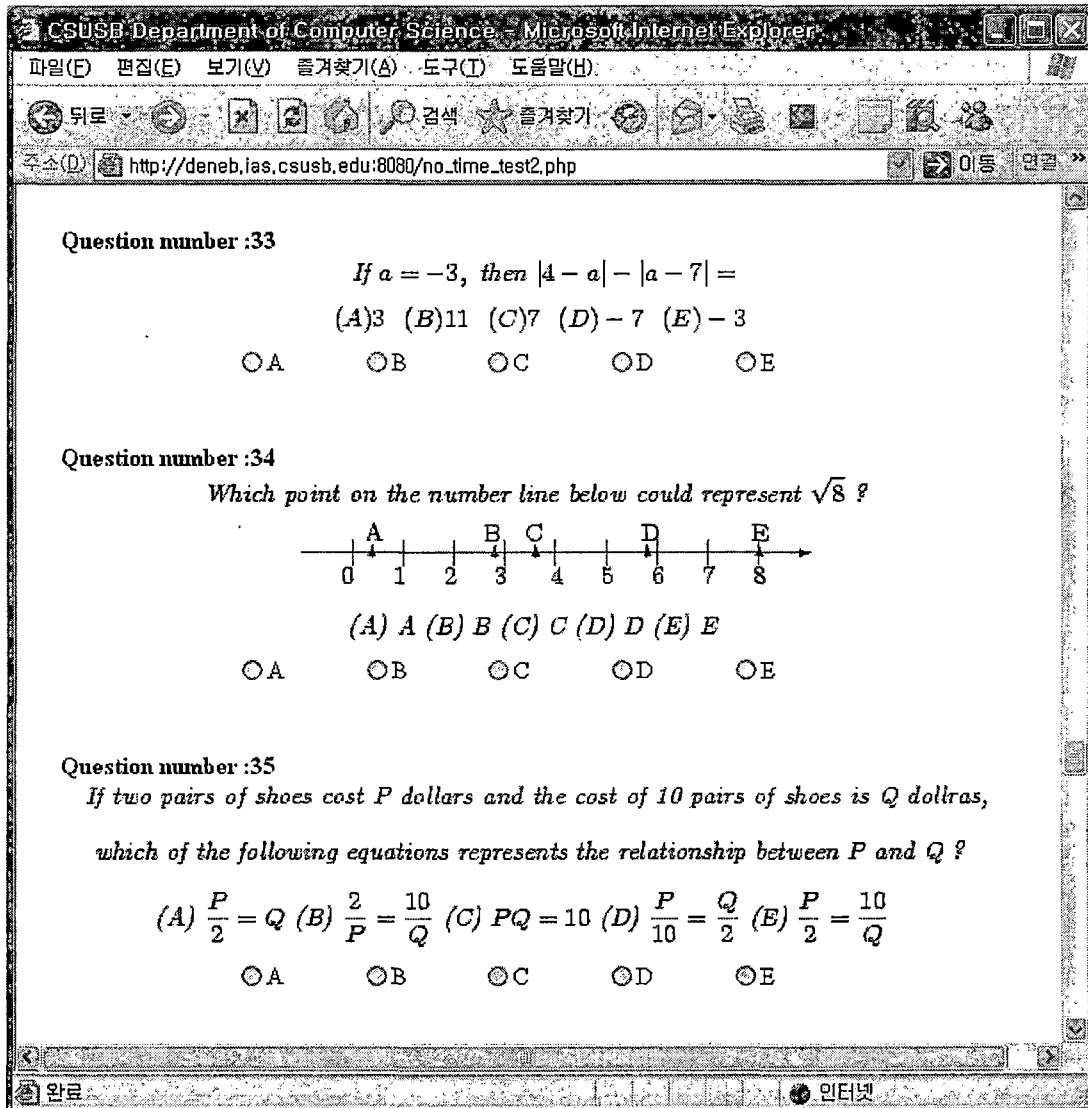


Figure 2.30 UnTimed ELM Test2 Page

- UnTimed ELM Test3 Page. On this page, the student can take untimed ELM test3. ELM test3 consists of 50 questions.

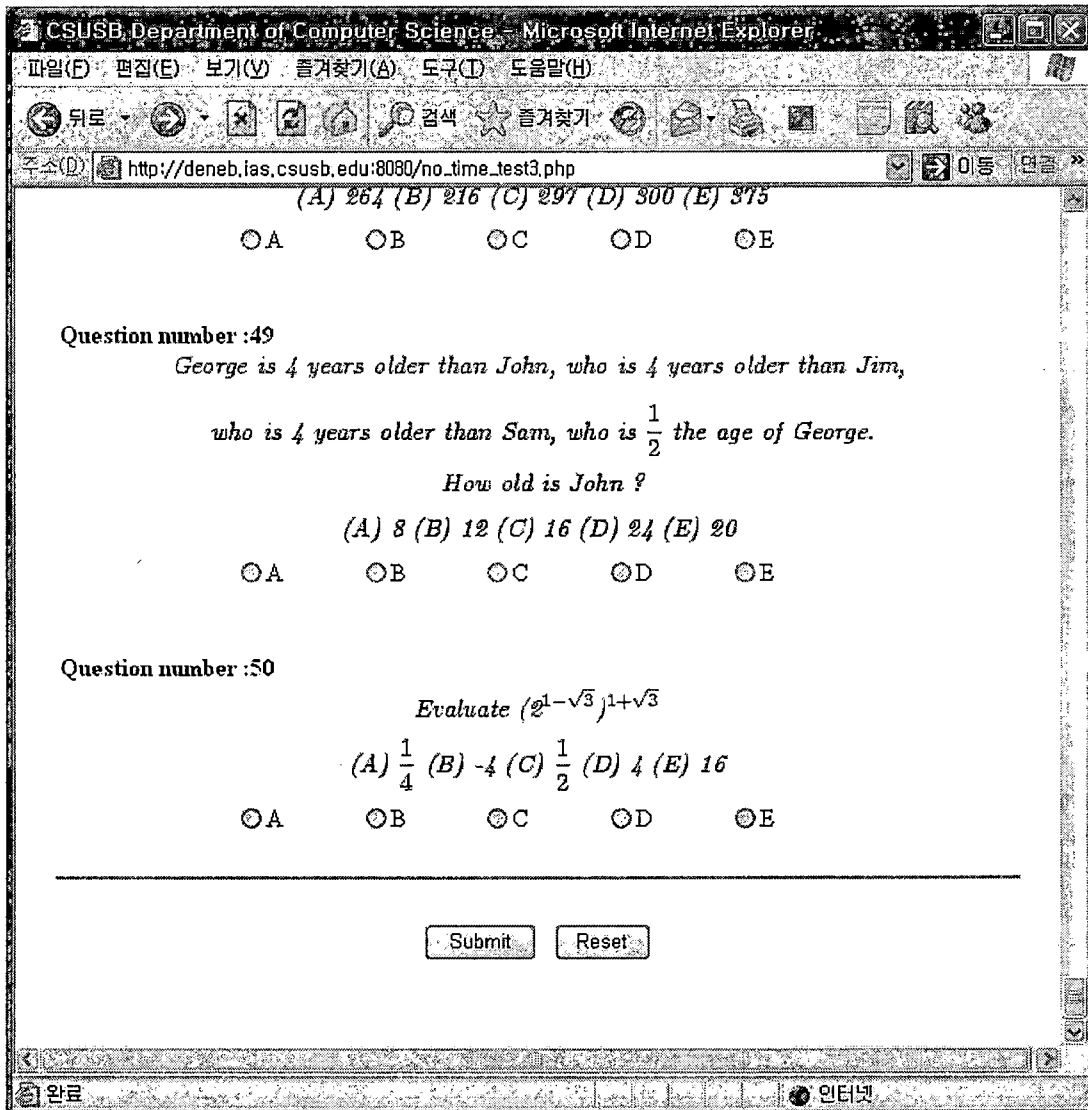


Figure 2.31 UnTimed ELM Test3 Page

- Timed ELM Test List Page. On This Page, there is a list of three timed ELM tests. The Student can take any of the three timed ELM tests.

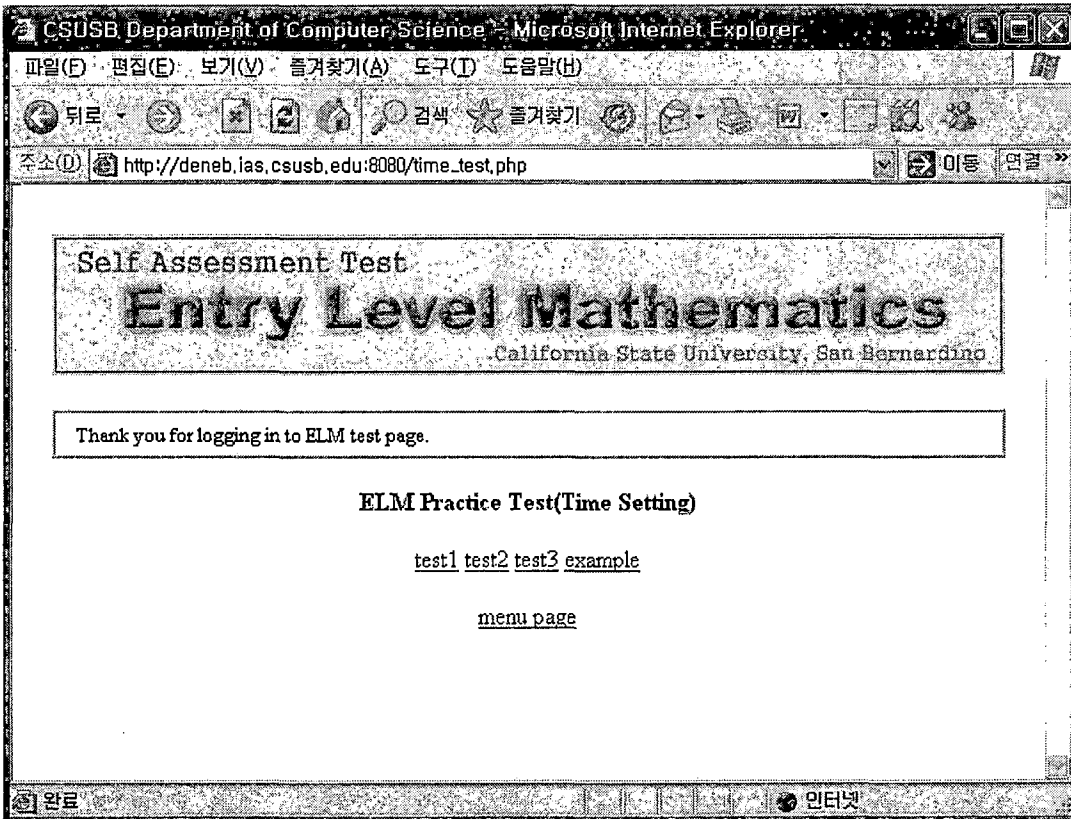


Figure 2.32 Timed ELM Test List Page.

- Timed ELM Test1 Page. On this page, the student can take timed ELM test1. ELM test1 consists of 50 questions. He/she must finish the test within 90 minutes. If not, the test session will be terminated. Wrong answers are assumed for the

remaining unanswered questions. When he/she is done, he/she can click the submit-button. On next page, he/she can check scores and answers.

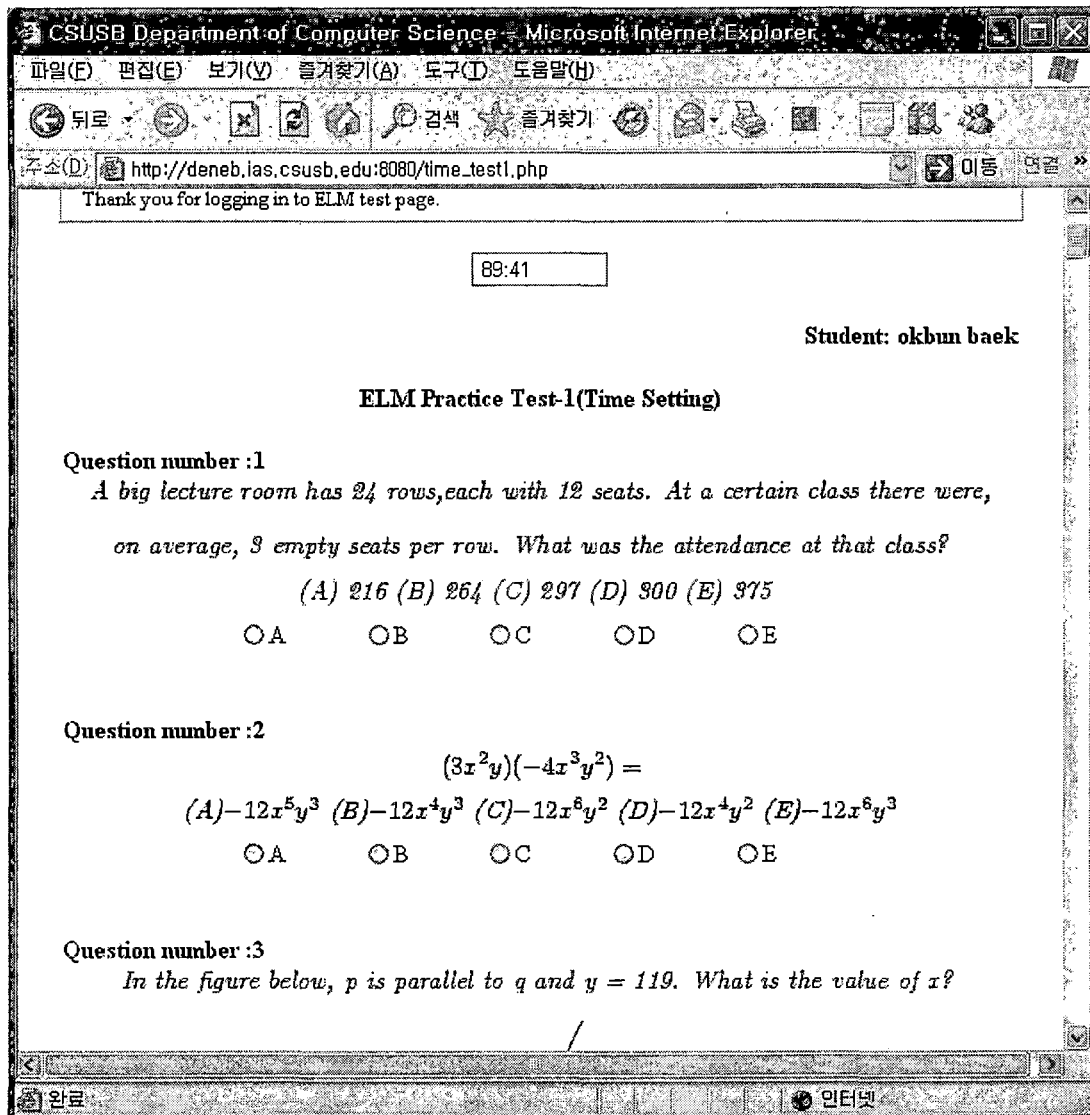


Figure 2.33 Timed ELM Test1 Page

- Timed ELM Test2 Page. On this page, the student can take timed ELM test2. ELM test2 consists of 50 questions. He/she should finish the test within 90 minutes. A procedure of the timed test2 is same as the timed test1.

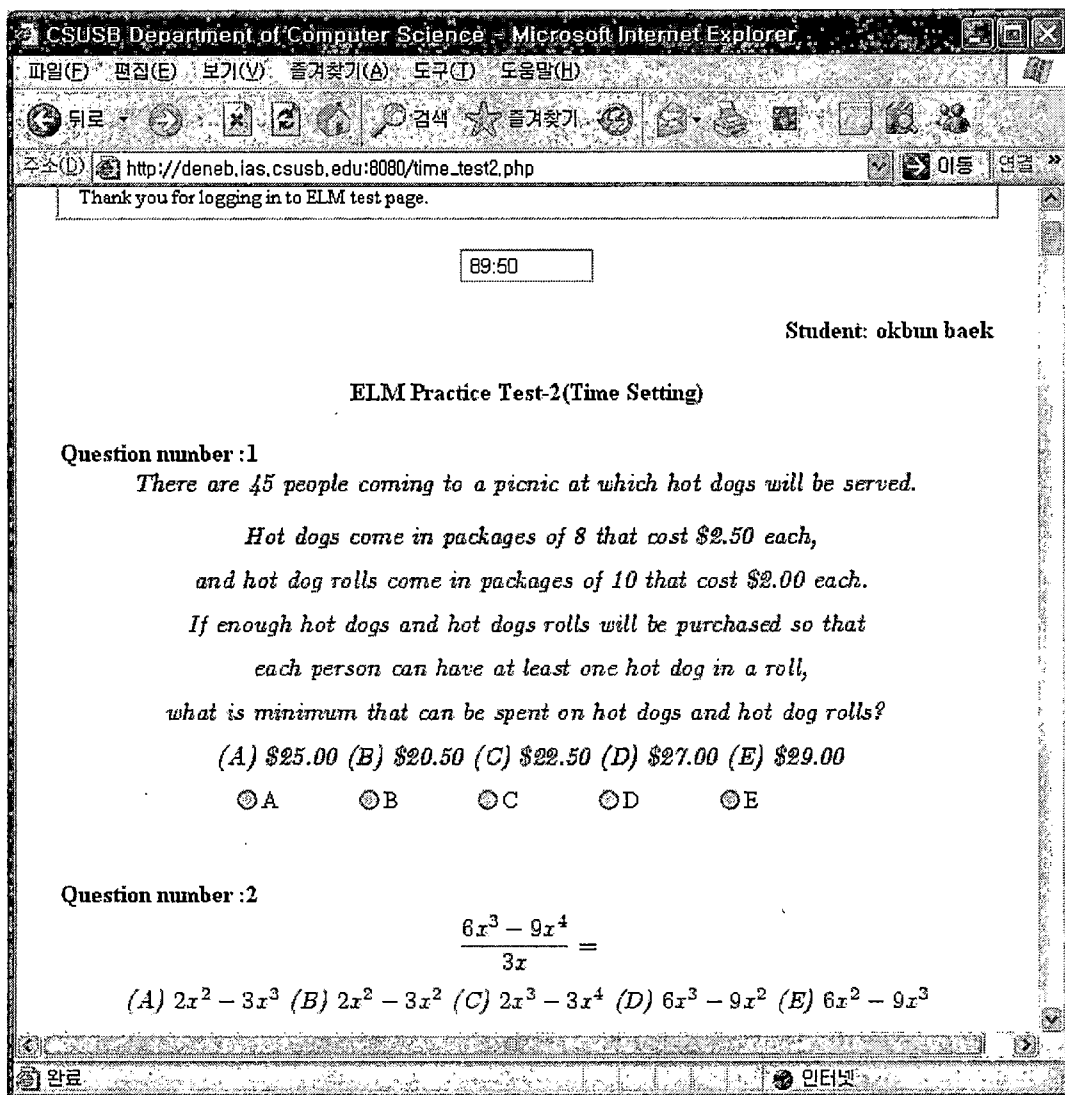


Figure 2.34 Timed ELM Test2 Page

- Timed ELM Test3 Page. On this page, the student can take timed ELM test3. ELM test3 consists of 50 questions. He/she has to finish the test within 90 minutes. The procedure of the timed test3 is same as the timed test1 and timed test2.

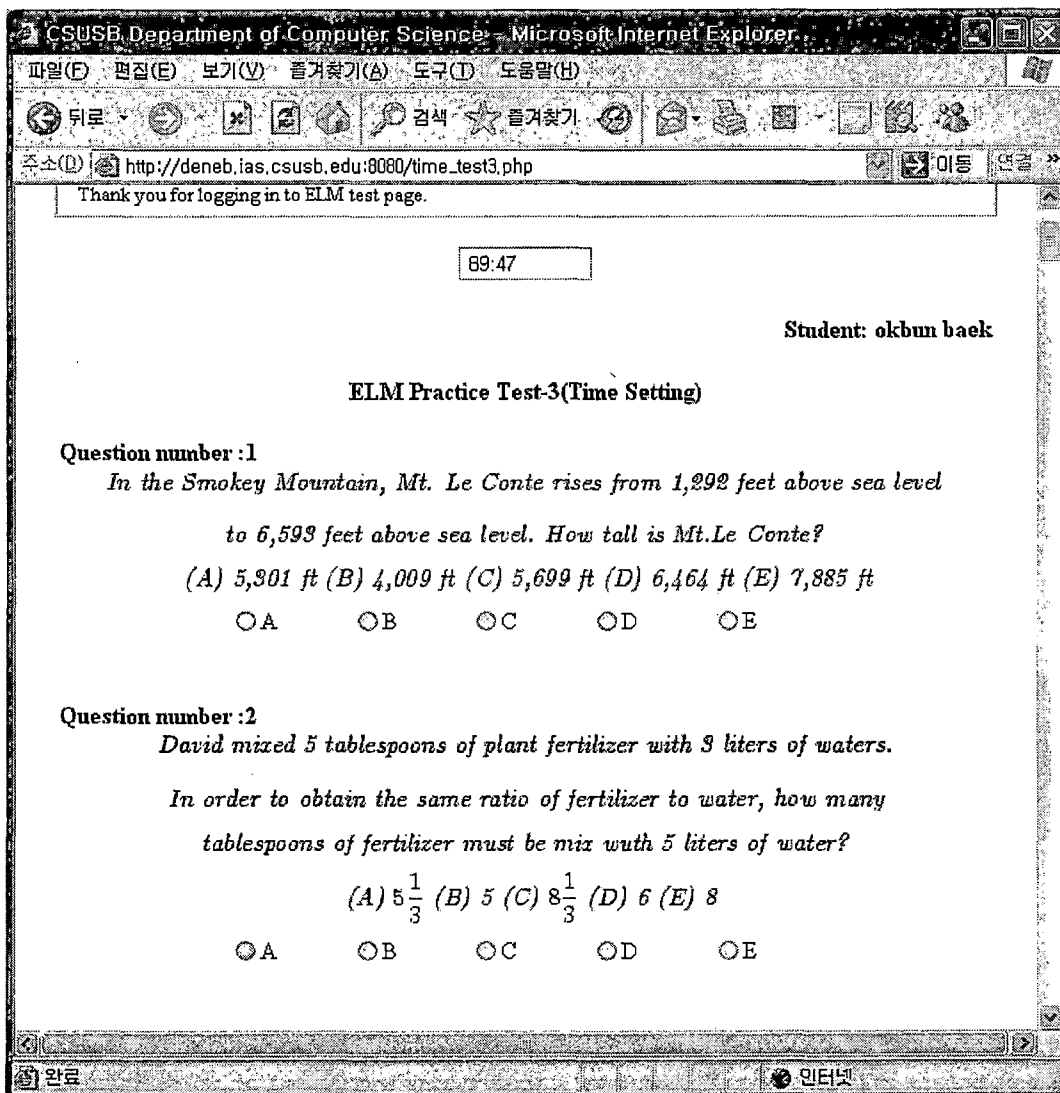


Figure 2.35 Timed ELM Test3 Page

- Display Page for Student ELM Score. On this page, the student can see total his/her ELM scores. He/she can check his/her total history of all ELM tests, that is, untimed ELM tests and timed ELM tests.

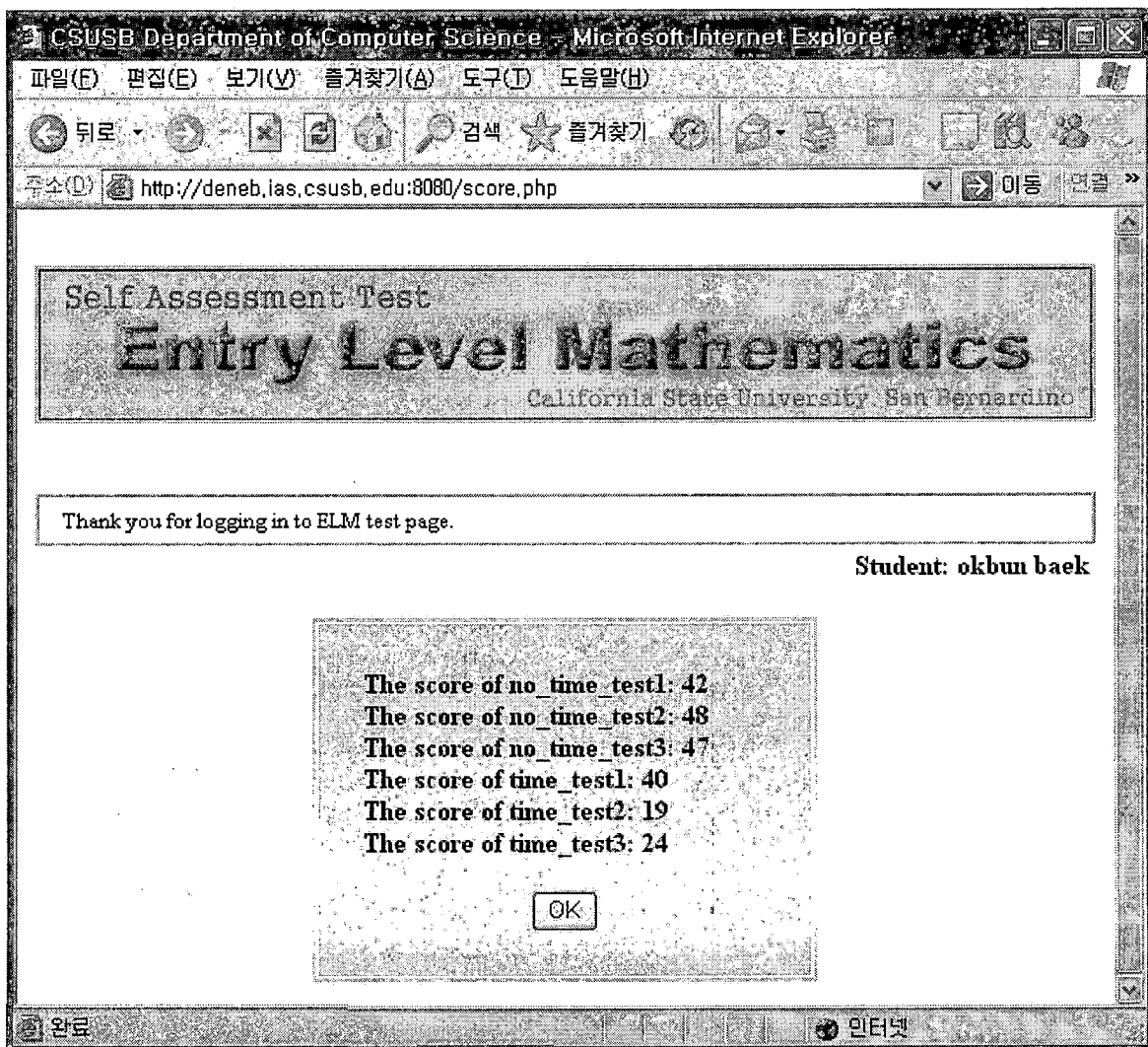


Figure 2.36 Display of Student's All ELM Tests Scores

2.3.2 Performance Requirements

This section provides a summary of the major functions that WebELMT performs. When a student wants to login WebELMT, he/she inputs username and password. If he/she is a new student, he/she must input all information: student ID, username, password, first name, last name, e-mail. Upon successful login, he/she can take three major ELM tests, either untimed or timed. Then he/she can check his/her ELM test score. Answers can be reviewed as well.

2.3.3 Logical Database Requirements

WebELMT will store all the data in MySQL. The name of database used for this project is welm. There are eight tables used for this project: admin, student, numbers and data, algebra, geometry, test1, test2, and test3.

2.3.4 Design Constraints

2.3.4.1 Standards Compliance. The data structures and algorithms will comply with those accepted in publicly available documents and texts.

2.3.5 Software System Attributes

2.3.5.1 Reliability. The server where WebELMT will be located is functional.

2.3.5.2 Availability. This project will be accessed to limited users such as system administrator and student in order to maintain confidentiality of private information.

2.3.5.3 Maintainability. The majority of WebELMT is implemented with PHP scripts and HTML codes, so any web development tools handling PHP and HTML like Macromedia Dreamweaver provide easy way of maintenance.

2.3.5.4 Portability. WebELMT is designed to be operated from any web browsers with any operating system platform.

CHAPTER THREE

SOFTWARE DESIGN

3.1 Architecture Design

3.1.1 System Design

WebELMT consists of three components: WebELMT server, database, and LaTeX document system. The core part of this system is the WebELMT server. WebELMT provides its services over the internet. To implement WebELMT services, a server side embedded scripting language is needed. Among many server side scripting languages, PHP was selected for this project because of its powerful functions and fast loading time of a browser. WebELMT uses a database to manage student account information and ELM questions. Because PHP and MySQL are a perfect combination to implement Web-based database application, MySQL is selected as the WebELMT database server. In addition, the LaTeX document system is used to display ELM question. LaTeX document system is a very convenient system to display math questions. From the LaTeX document system, when the administrator inputs the LaTeX file on the web-browser, the file is saved in MySQL, next converted to PNG file in PHP, and displayed on the web.

Linux/Apache/MySQL/PHP is a very popular system in the open-source community. Apache is also a popular Web server running on Linux. MySQL is handy and a fast database program which has many libraries of Apache. PHP is a web programming language that is run as a module of Apache and has native MySQL libraries. These provide a very stable process and produce fewer problems than many other web programming languages.

3.1.2 Database Design

The database has a crucial role in this project. The generated data are stored and retrieved in a database. The database design is shown in an Entity-Relationship Diagram. The ER Diagram is translated to a relational database schema. The relational database schema shows all objects in ER diagram as a series of related tables.

3.1.2.1 Entity-Relationship Diagram. The ER diagrams show all entities, attributes, constraints, and relationships between entities.

- Login ER is for administrator management. The entity keeps the admin ID and password for login.

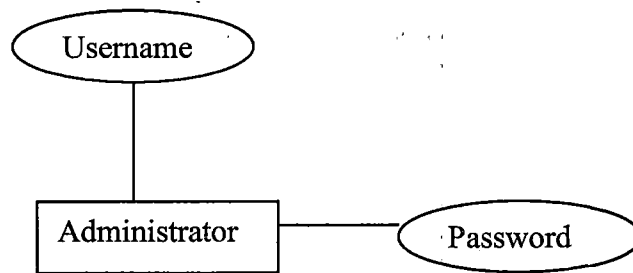


Figure 3.1 Login Entity-Relationship Diagram for Administrator.

- Login ER is for Student management. The entity keeps the Student ID, last name, first name, username, password, and e-mail for login.

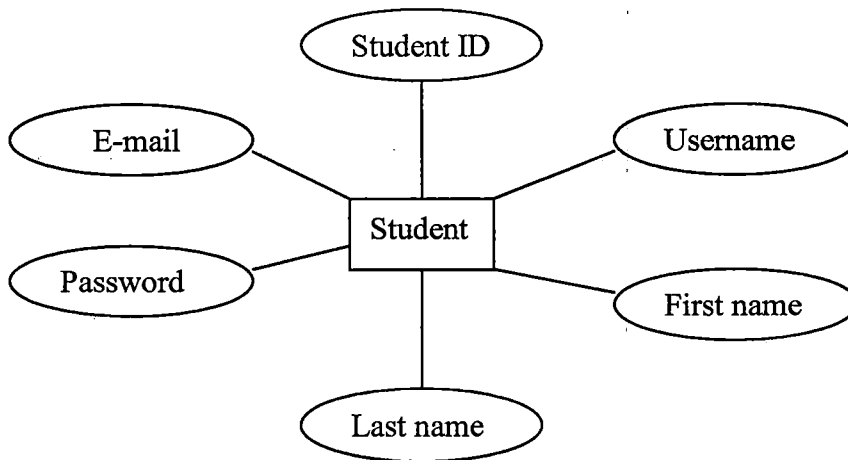


Figure 3.2 Login Entity-Relationship Diagram for Student.

- ER Diagram for ELM test management. The ELM test and question entity keeps question number, question, answer, level, and topic.

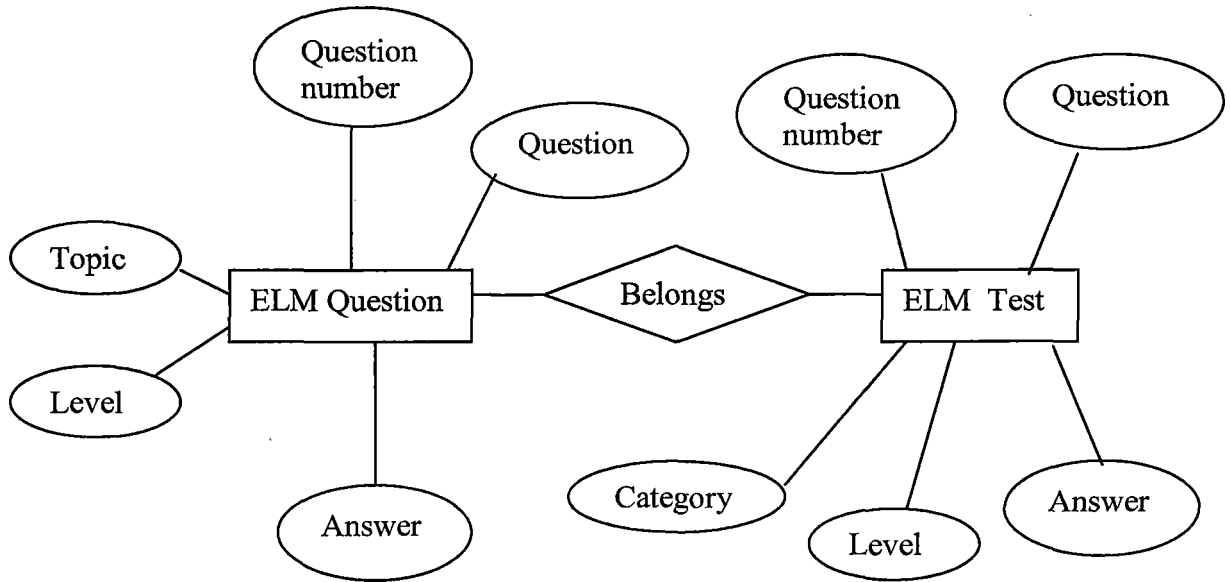


Figure 3.3 Entity-Relationship Diagram for ELM Question Management

3.1.2.2 Relational Database Tables. The relational database table of WebELMT consists of eight relational tables: Administrator, Student, Numbers and Data, Algebra, Geometry, test1, test2, and test3. The characteristics of each table are described on Tables 3.1 - 3.4. The

administrator table consists of username, password, first name, and last name. The student table consists of student ID, first name, last name, username, password, e-mail, untimed test1, untimed test2, untimed test3, timed test1, timed test2, and timed test3. The numbers and data table consists of number, question, answer, level, and topic. The algebra table consists of number, question, answer, level, and topic. The geometry table consists of number, question, answer, level, and topic. The test1, test2, and test3 tables consist of question number, question, answer, level, and topic.

Table 3.1 Administrator Table

Field Name	Data Type	Description
Number	Int(11)	Identification number of Admin. This number is incremental.
Username	Varchar(16)	This is login name of Admin.
Password	Varchar(16)	Password for Admin to login.
First Name	Varchar(16)	This is first name of Admin.
Last Name	Varchar(16)	This is last name of Admin.

Table 3.2. Student Table

Field Name	Data Type	Description
S_ID	Varchar(16)	Identification number of each student. Primary key.
First Name	Varchar(20)	This is first name of student.
Last Name	Varchar(20)	This is last name of student.
Username	Varchar(16)	This is login name of student.
Password	Varchar(16)	Password for login of student.
E-Mail	Varchar(40)	E-mail for student.
No_Time_Test1	Int(11)	Score of no_time_test1.
No_Time_Test2	Int(11)	Score of no_time_test2.
No_Time_Test3	Int(11)	Score of no_time_test3.
Time_Test1	Int(11)	Score of time_test1.
Time_Test2	Int(11)	Score of time_test2.
Time_Test3	Int(11)	Score of time_test3.

Table 3.3. Numbers and Data, Algebra, and Geometry Table

Field Name	Data Type	Description
Num	Int(11)	This is a number of Question. Primary Key.
Question	Text	ELM question. Latex document system.
Answer	varchar(10)	This is Answer of question.
Level	Varchar(10)	This is level of ELM question.
Topic	Varhar(100)	This is topic of ELM question.

Table 3.4. ELM Test Table

Field Name	Data Type	Description
Num	Int(11)	This is a question number on the test. Primary Key.
Question	Text	ELM question. Latex document system.
Answer	Varchar(10)	This is an answer of question on the test.
Level	Varchar(10)	This is a level of the ELM question on the test.
Category	Varchar(20)	This is a category of the ELM question on the test.

3.2 Detailed Design

This section describes the detailed design as pseudo-code algorithms for all classes.

3.2.1 Administrator Login Class

The administrator Login class handles the administrator login/password functions. It also manages sessions for the rest of the Web pages so that any other Web pages would not be accessed directly.

```
Class name: Administrator Login
Purpose: check the admin login
Begin class

Session start

/* connect to mysql database */
Function mysql_connect:
Begin
    Establish connection to the mysql
End

Function checkLogin
Begin
    Execute SQL statement
    If user is in database
        Go to next page
    Else
        Go to index page
End checkLogin

End class
```

Figure 3.4. Administrator Login Class

3.2.2 Student Login Class

The student Login class handles the student login/password functions. It also manages sessions for the rest of the Web pages so that any other Web pages would not be accessed directly. If the student is a new student, he/she should go to create account page. In there, he/she must input his/her information: Student ID, First Name, Last Name, Username, Password, and E-mail. Particularly, he/she has to input password twice to confirm. The logic of this pseudo-code algorithm is as follows:

1. If student is a new student, he/she must go to an account creation page. Otherwise directly go to login page.
2. Connect to the database.
3. If the access is successful, go on to the next function, otherwise go back to the login page.
4. On the menu page, he/she can take ELM test.
5. If he/she has done the ELM test, he/she can verify ELM scores and answers.
6. He/she can practice the ELM test several times.
7. If he/she finishes the ELM test, he/she can log out.

```
Class name: Student Login
Purpose: check the student login
Begin class

If student is a new student,
go to create account page.

Otherwise go to login page.

Session start

/* connect to mysql database */
Function mysql_connect:
Begin
    Establish connection to the mysql
End

Function checkLogin
Begin
    Execute SQL statement
    If student is in database
        Go to next page
    Else
        Go to index page
End checkLogin

End class
```

Figure 3.5 Student Login Class

CHAPTER FOUR

SOFTWARE QUALITY ASSURANCE

4.1 Introduction

This chapter documents the software validation testing process for WebELMT. The purpose of the software validation test is to guaranty the quality of the software and its functionalities. Three testing processes are used to assure WebELMT software quality: unit testing, system testing, and system acceptance testing.

4.2 Unit Testing

Unit testing greatly improved the quality of WebELMT. It also accelerated the development of this project, since unit testing allowed individual modules to be tested before the entire program was completed.

4.3 System Testing

System testing involves examination of the whole system of WebELMT. All the software and hardware components and any interfaces are tested in this process. Table 4.1 shows the result of system testing for WebELMT.

Table 4.1. System Testing Results

System Testing	Result
Install Operating System (Fedora core 4) in a X86 System box to make sure all of hardware components in functional with a Operating System	pass
Install and configure network components to make sure whether networking of the machine works correctly.	pass
Install apache web server and start httpd	pass
Install MySQL database and start a mysqld	Pass
Install WebELMT program on Web server	pass
Verify All Functions of WebELMT work with various real data	Pass

4.4 System Acceptance Testing

This section shows sample runs of WebELMT showing all the functions of WebELMT working correctly.

4.4.1 Administrator Testing

- Login Error Page. If an incorrect username or password is entered, a warning message page appears. This message will change to the login page in 2 seconds automatically.

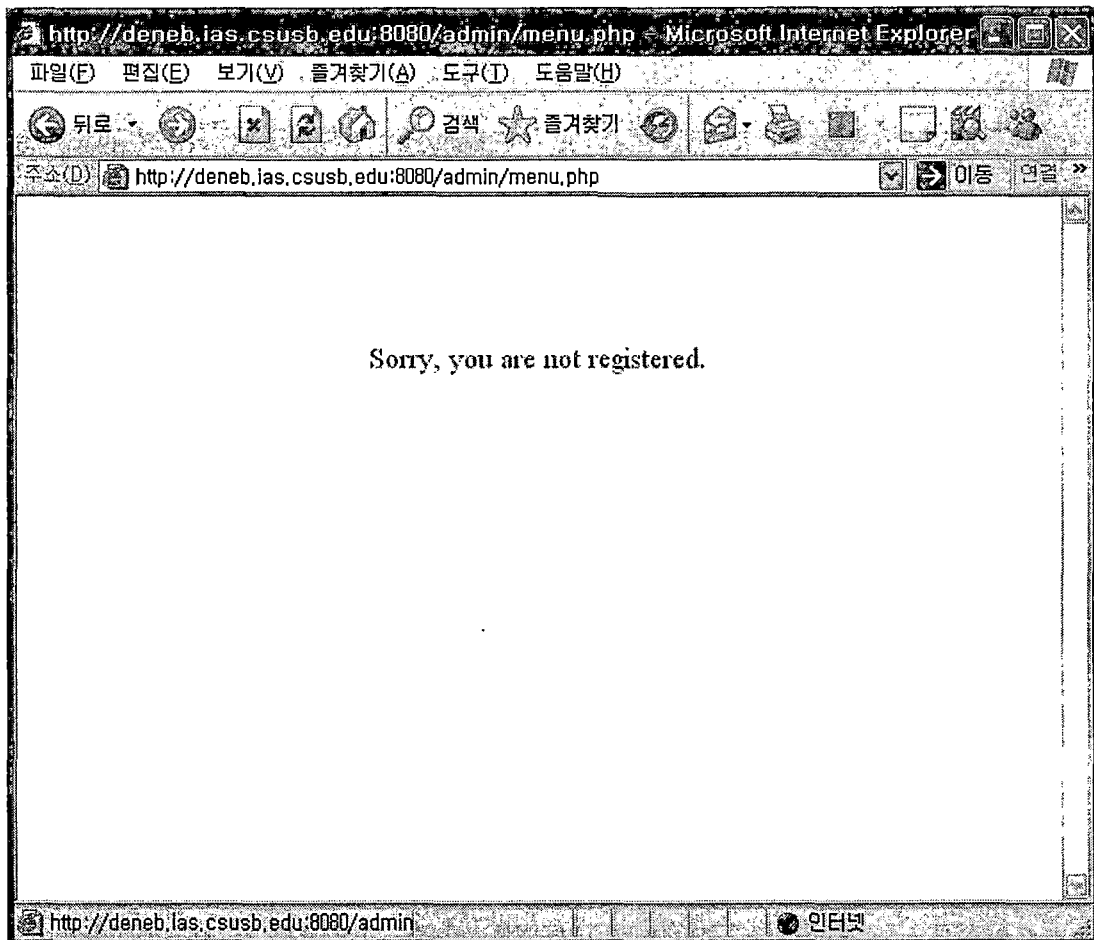


Figure 4.1. Administrator Login-Error Page.

- Create Numbers and Data Test Page. On this page, the administrator can create a numbers and data question in LaTeX form. The question number is created automatically based on the number of last question.

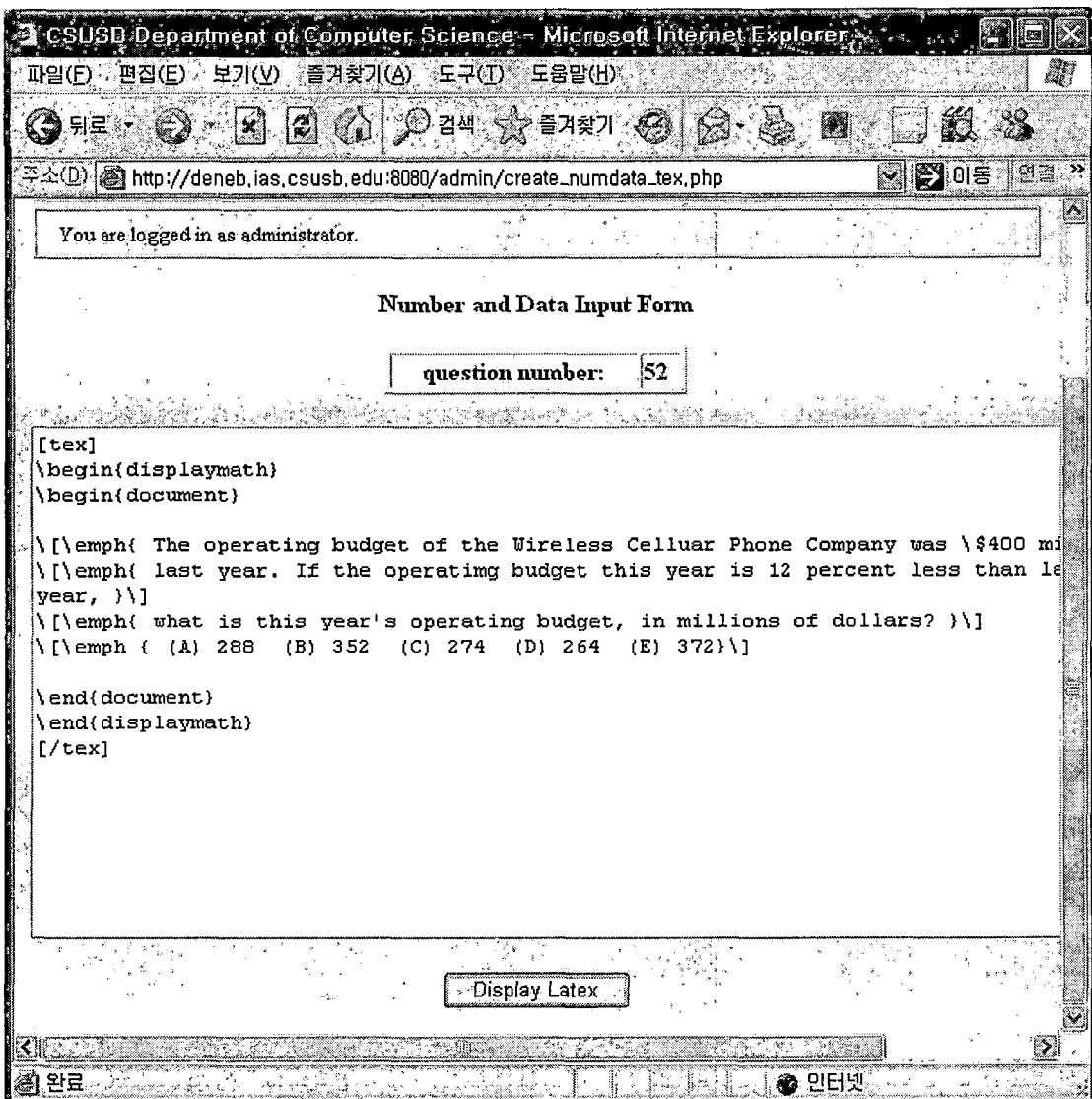


Figure 4.2. Create Numbers and Data Test Page.

- Created Numbers and Data Question Test Page. On this page, the administrator checks whether the new question is displayed well.

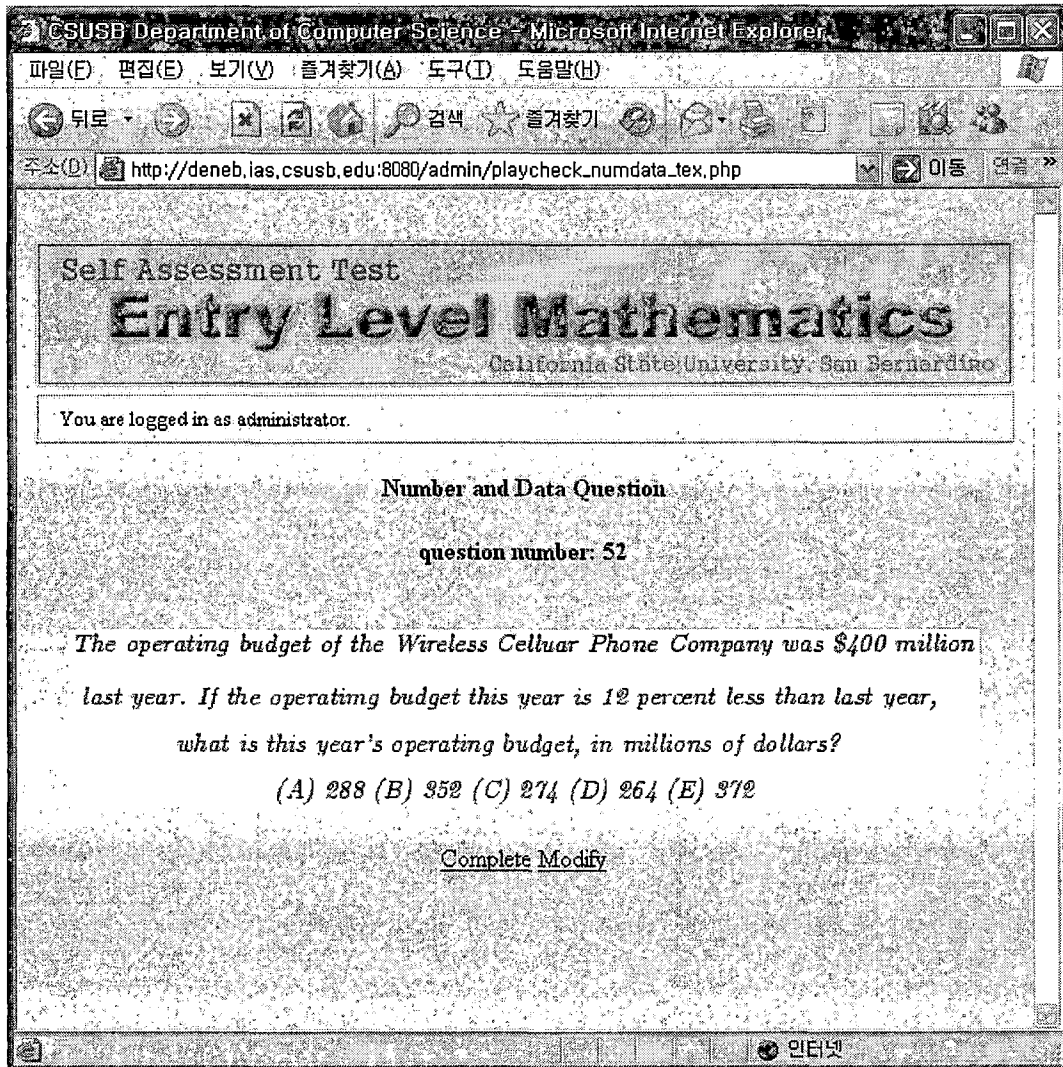


Figure 4.3 Created Numbers and Data Question Test Page.

- Complete Page for Numbers and Data Question. On this page, the administrator can complete the question display. But when the question is not correct, admin will go to the modify page in order to modify the question.

Figure 4.4 Complete Page for Numbers and Data Question.

- Check the New Numbers and Data Question Completed.

Finally, a new question for Numbers and Data question is completed in this page.

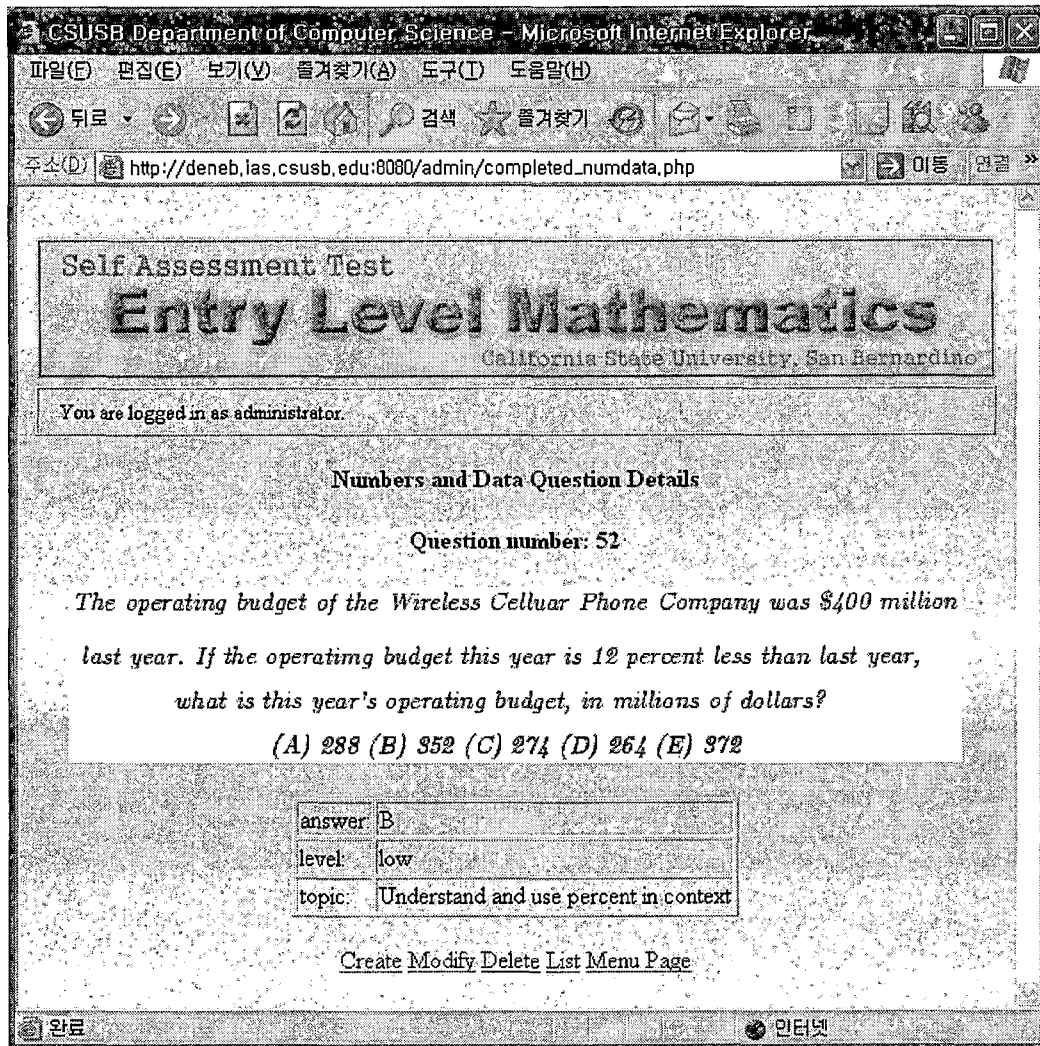


Figure 4.5. Completed Numbers and Data Question.

- Check for the New Question in List Page. On this Page, the administrator can check the new question

to be or not to be on the numbers and data question list.

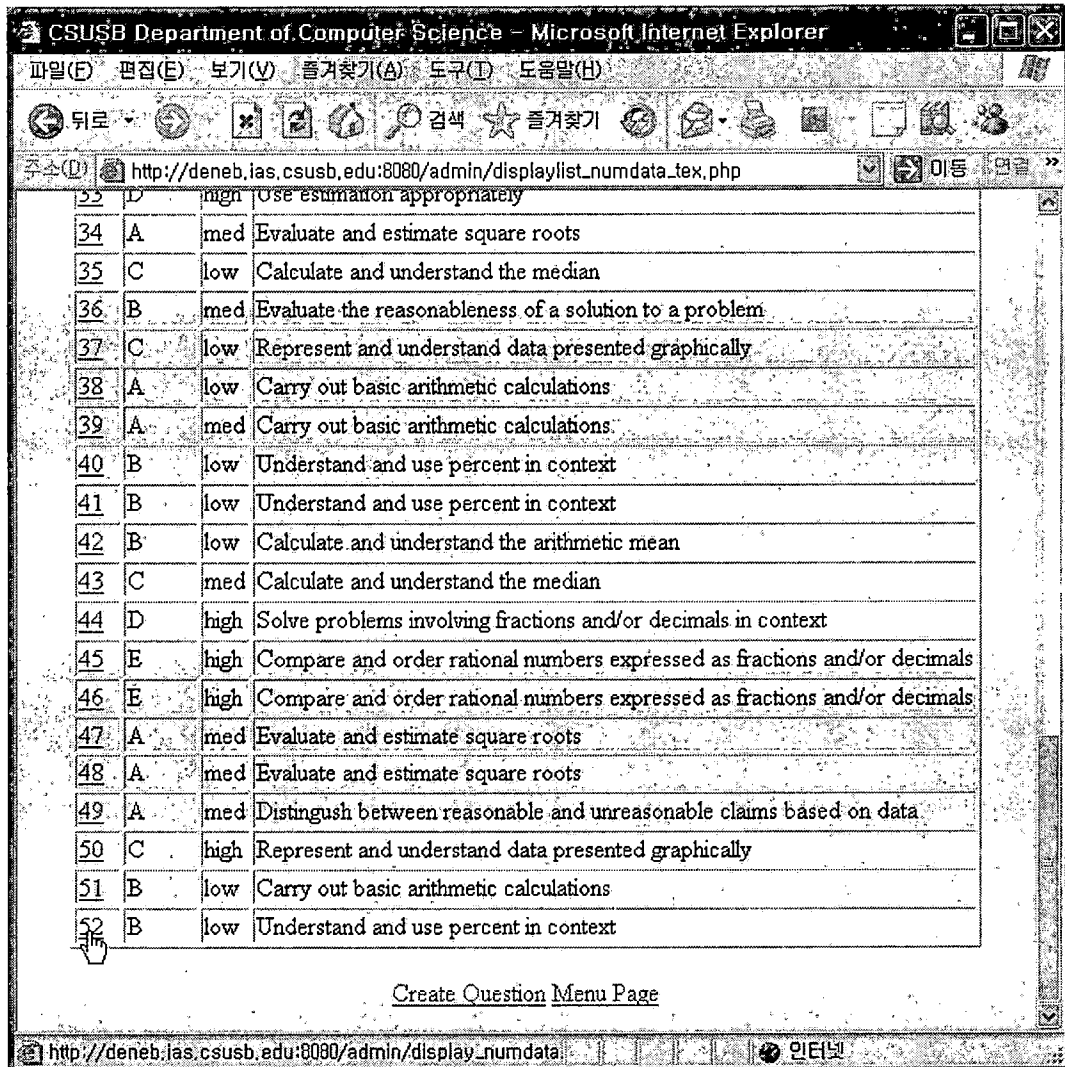


Figure 4.6 Check the New Numbers and Data Question

- Create Algebra Question Page. On this page, the administrator can create an algebra question in

LaTeX form. The question number is created automatically based on the number of the last question.

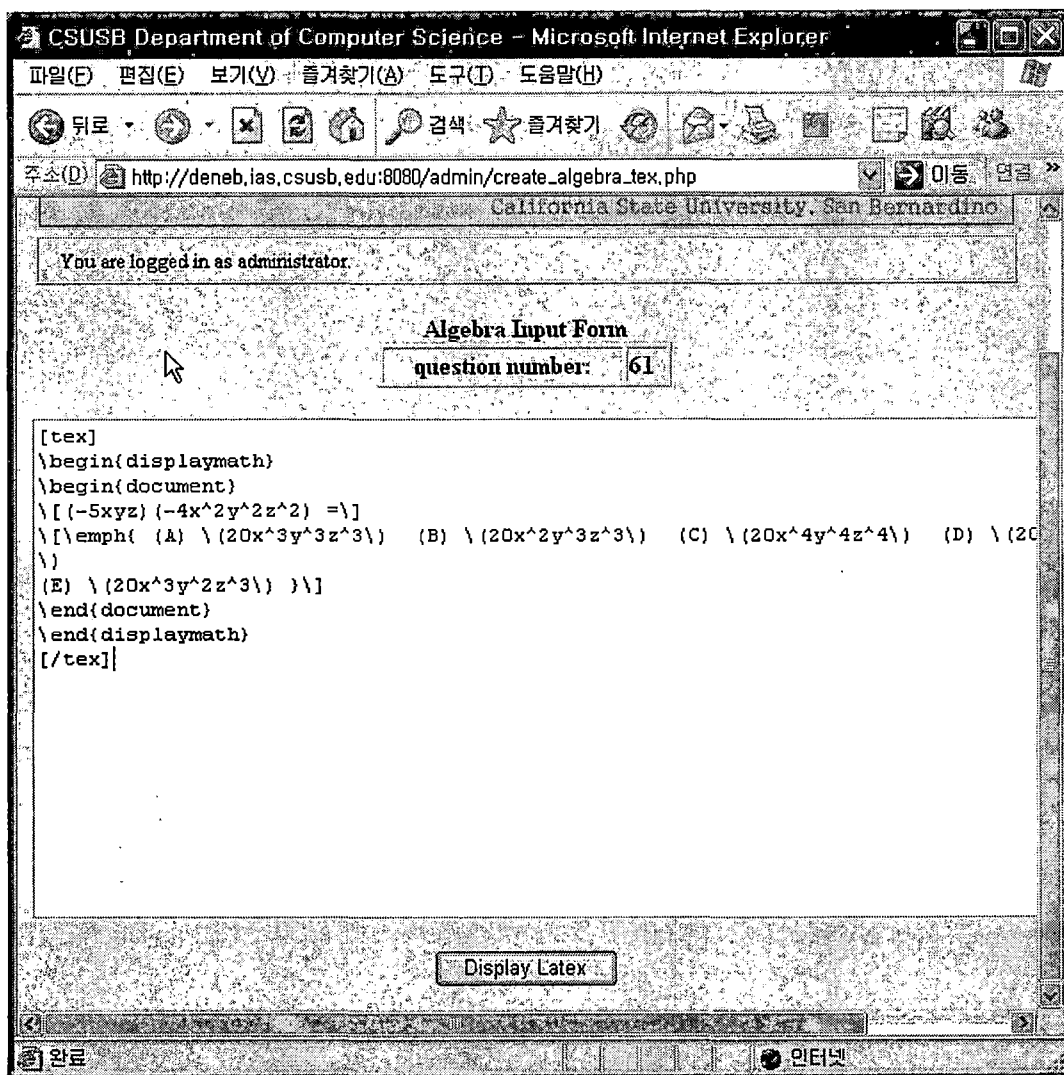


Figure 4.7 Create Algebra Question Page.

- Check a New Algebra Question in LaTeX Form. On this page, the administrator checks whether the new algebra question is displayed well.

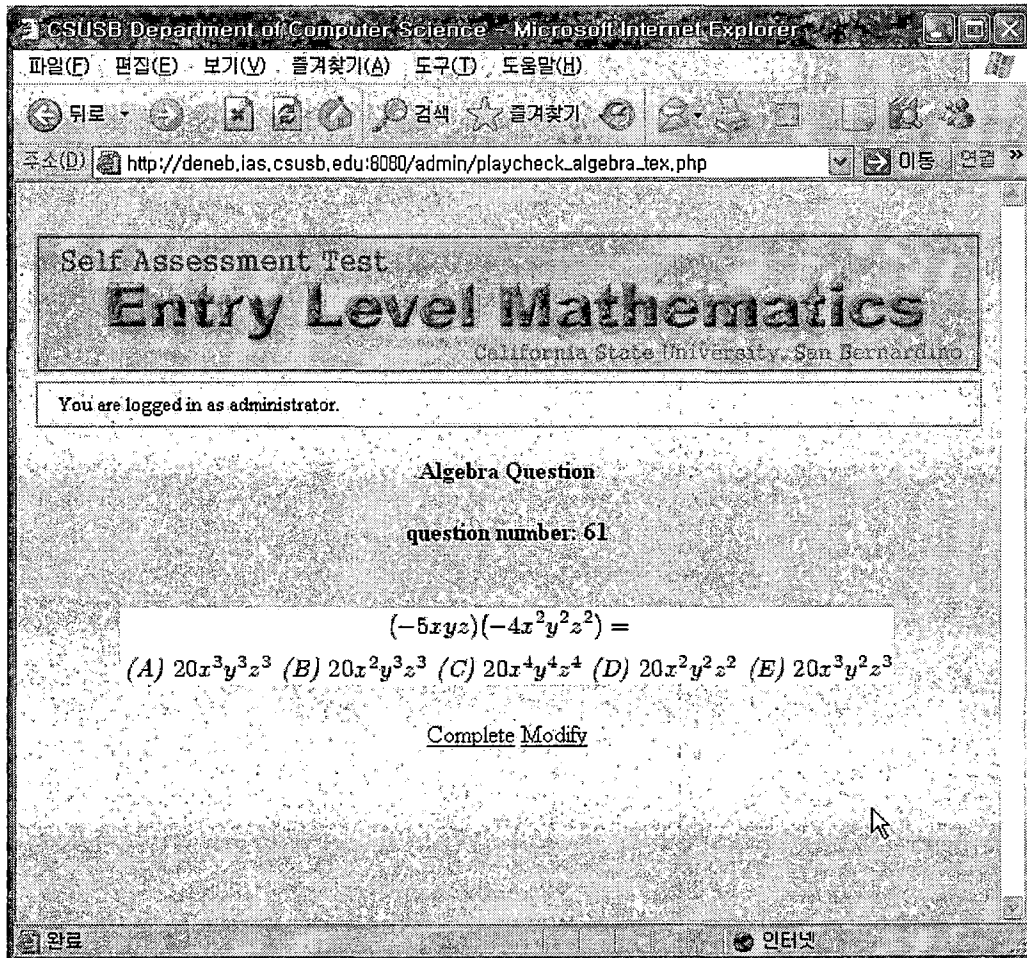


Figure 4.8. Created Algebra Question Page.

- Complete Page for Algebra Question Display. On this page, the administrator can complete the question display. But when the question is not

correct, the administrator will go to the modify page.

CSUSB Department of Computer Science - Microsoft Internet Explorer

주소(D) http://deneb.las.csusb.edu:8080/admin/complete_algebra.php?num=61

Self Assessment Test

Entry Level Mathematics

California State University, San Bernardino

You are logged in as administrator.

Algebra Complete Form

Question number: 61

$(-5xyz)(-4x^2y^2z^3) =$

(A) $20x^3y^3z^3$ (B) $20x^2y^3z^3$ (C) $20x^4y^4z^4$ (D) $20x^2y^2z^2$ (E) $20x^3y^2z^3$

answer:

level:

topic:

[Algebra List Menu Page](#)

Figure 4.9. Complete Algebra Question Page.

- Check the New Algebra Question Completed. Finally, a new question for algebra question is completed on this page.

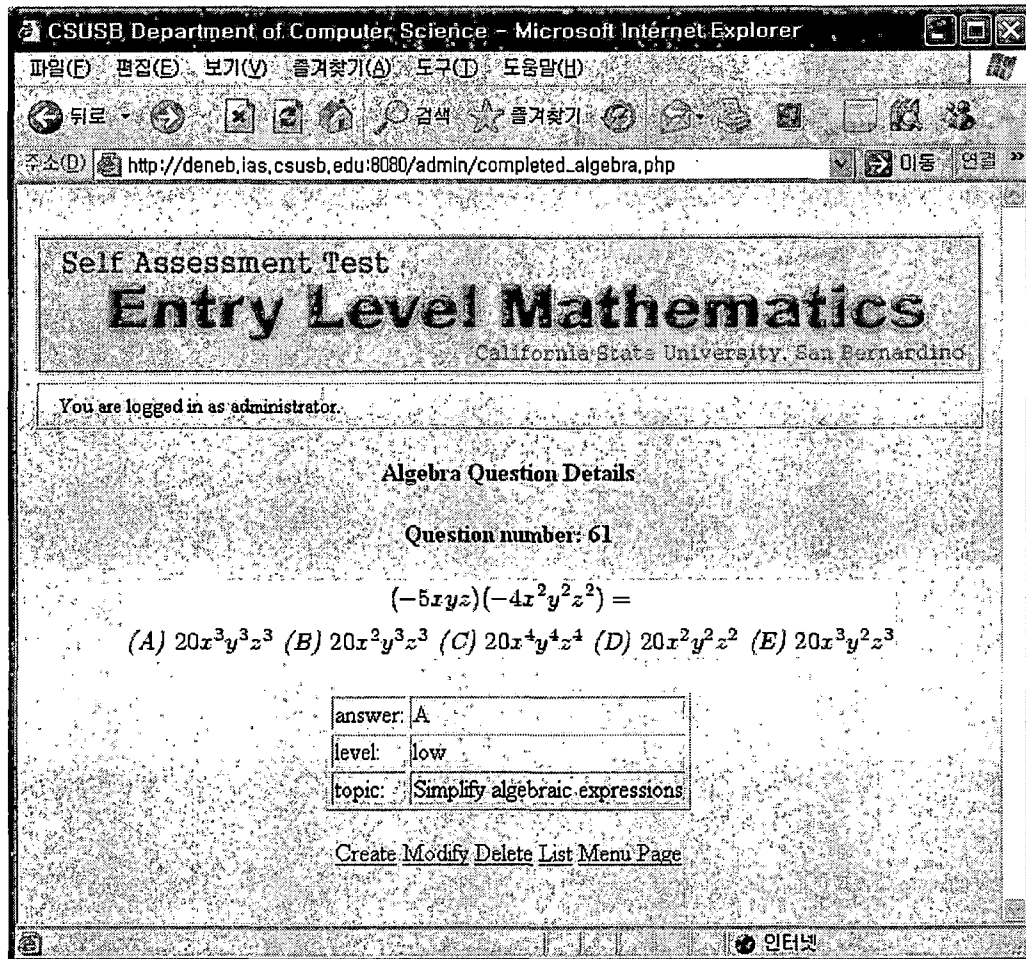


Figure 4.10. Completed Algebra Question

- Check for the New Question in List Page. On this page, the administrator can check the new question to be or not to be on the algebra question list.

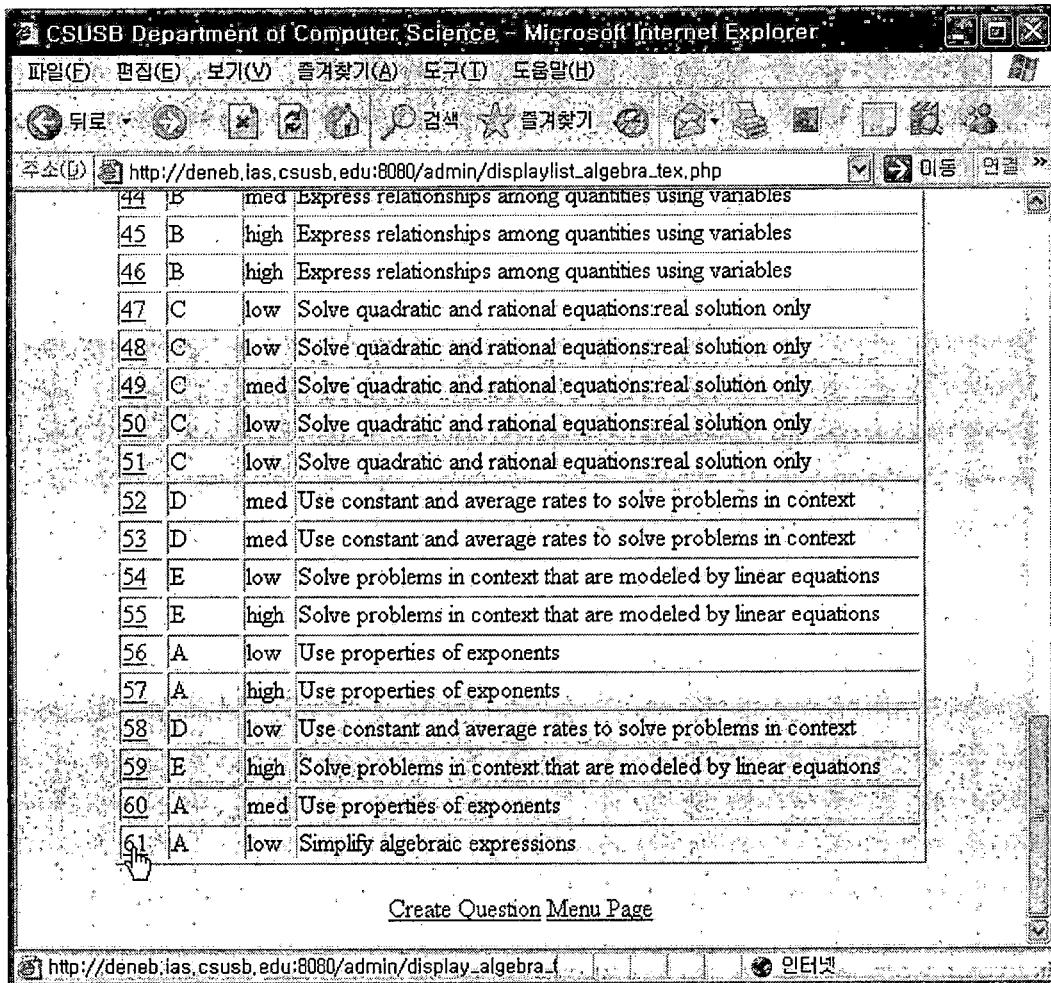


Figure 4.11. Check for New Algebra Question in List

- Create Geometry Question Page. On this page, the administrator can create a geometry question in LaTeX form. The question number is created

automatically based on the number of the last question.

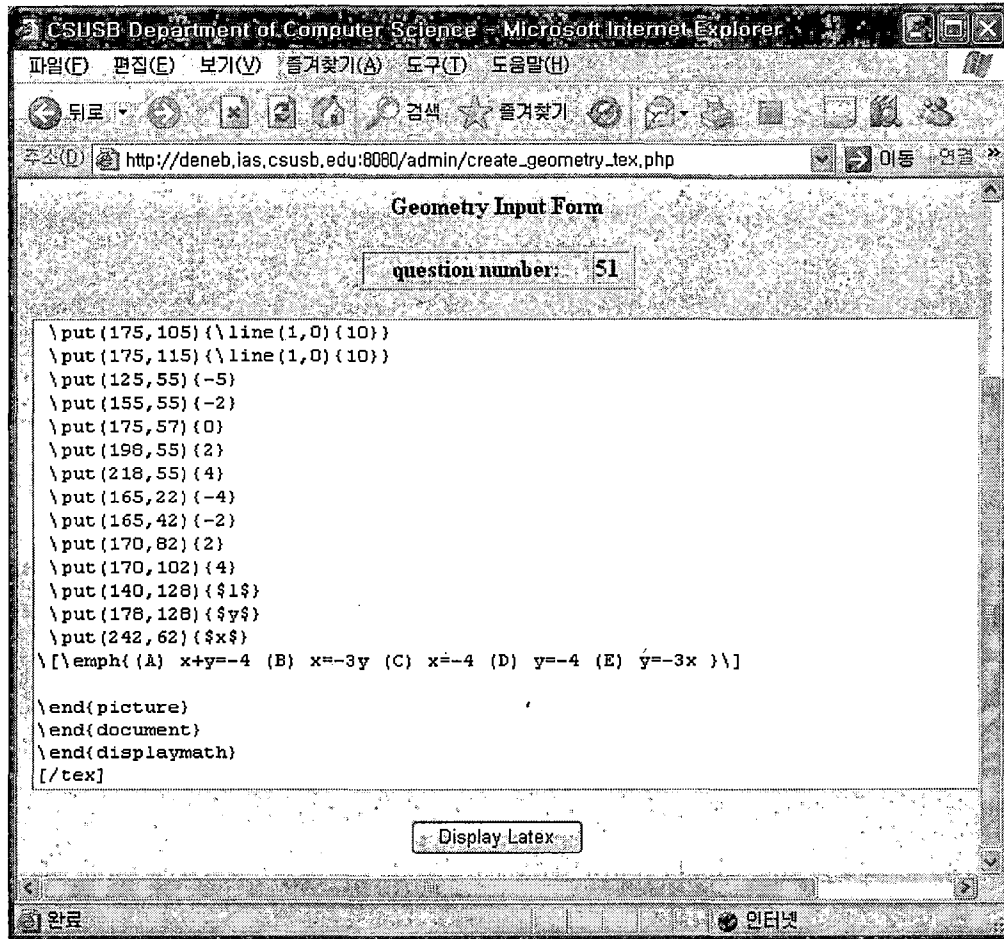


Figure 4.12. Create Geometry Question

- Check for New Geometry Question Display. On this page, the administrator checks whether the new geometry question is displayed well.

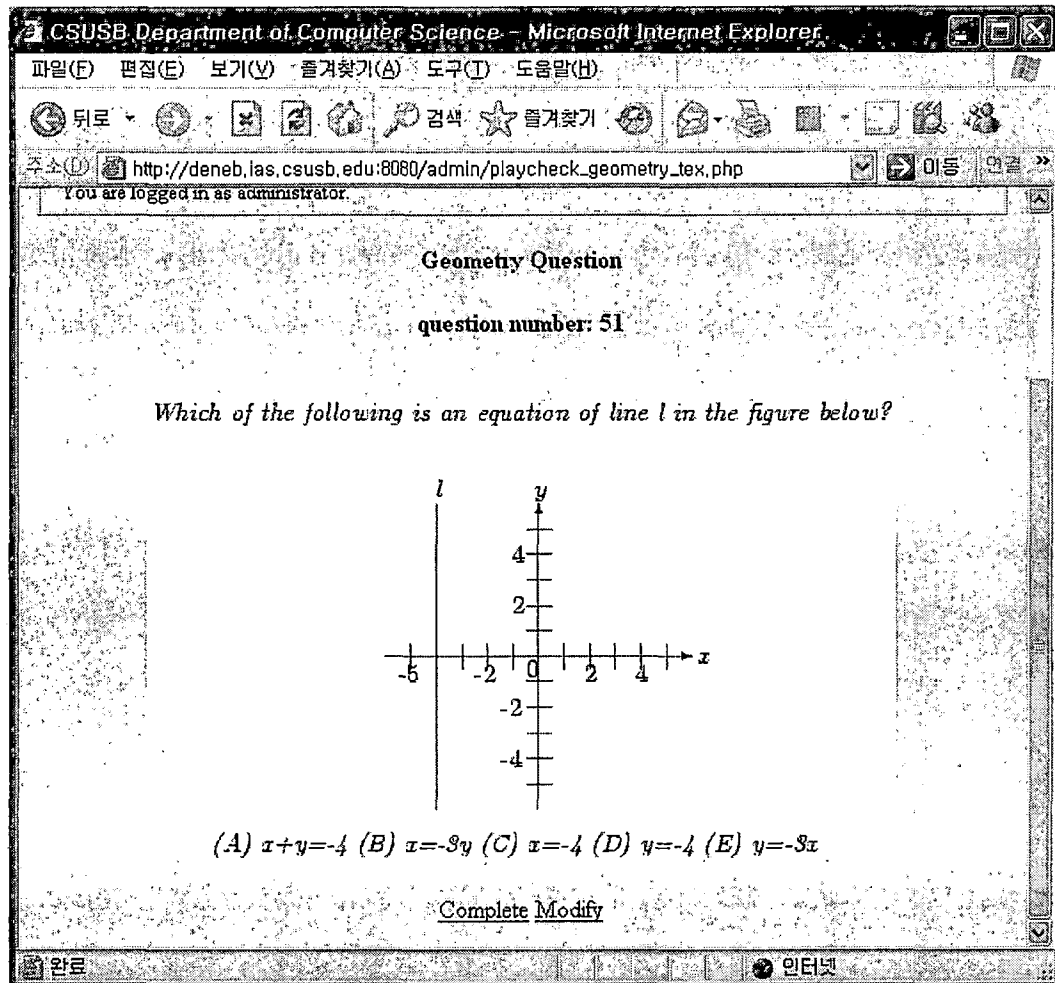


Figure 4.13 New Geometry Question Display

- Complete Page for Geometry Display. On this page, the administrator can complete the question display. But when the question is not correct, the administrator will go to the modify page.

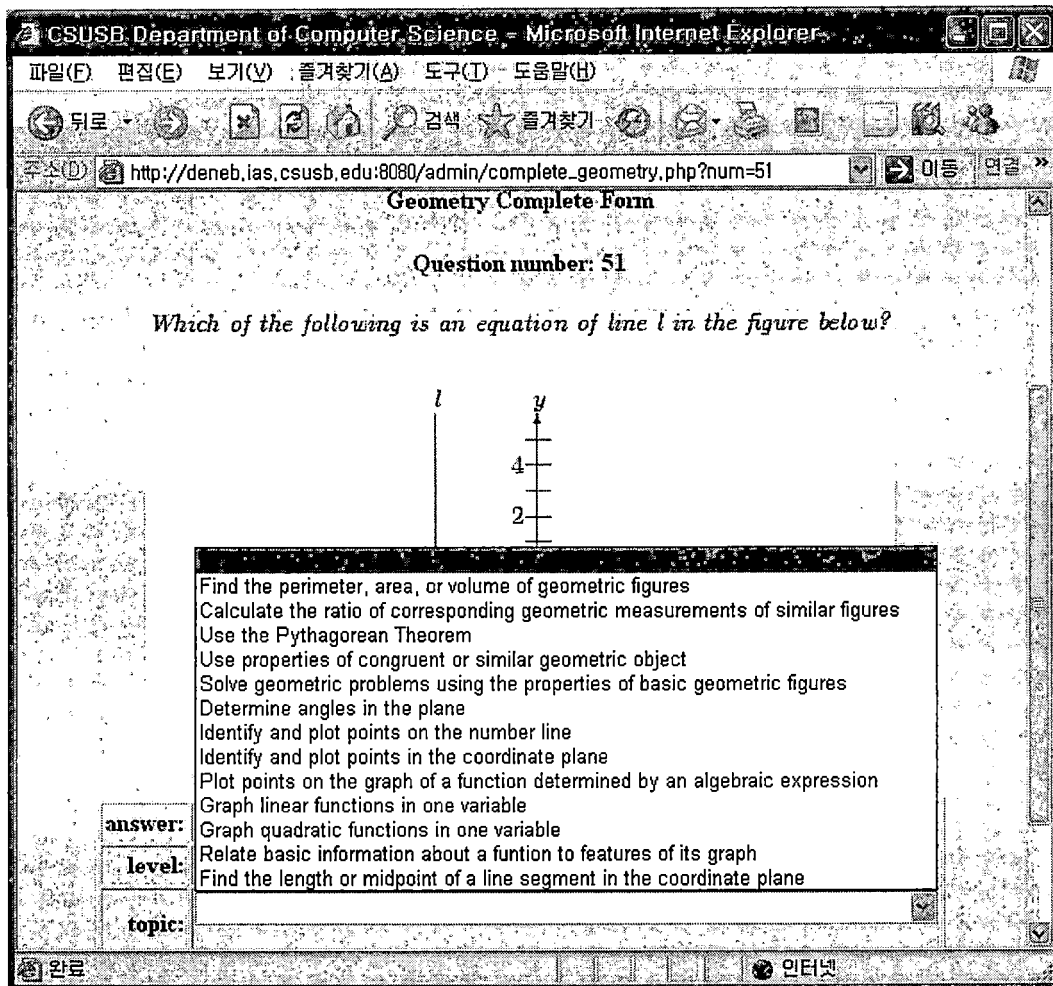


Figure 4.14 Complete Page of Geometry Question

- Check the New Geometry Question Completed. Finally, a new question for the geometry test is completed on this page.

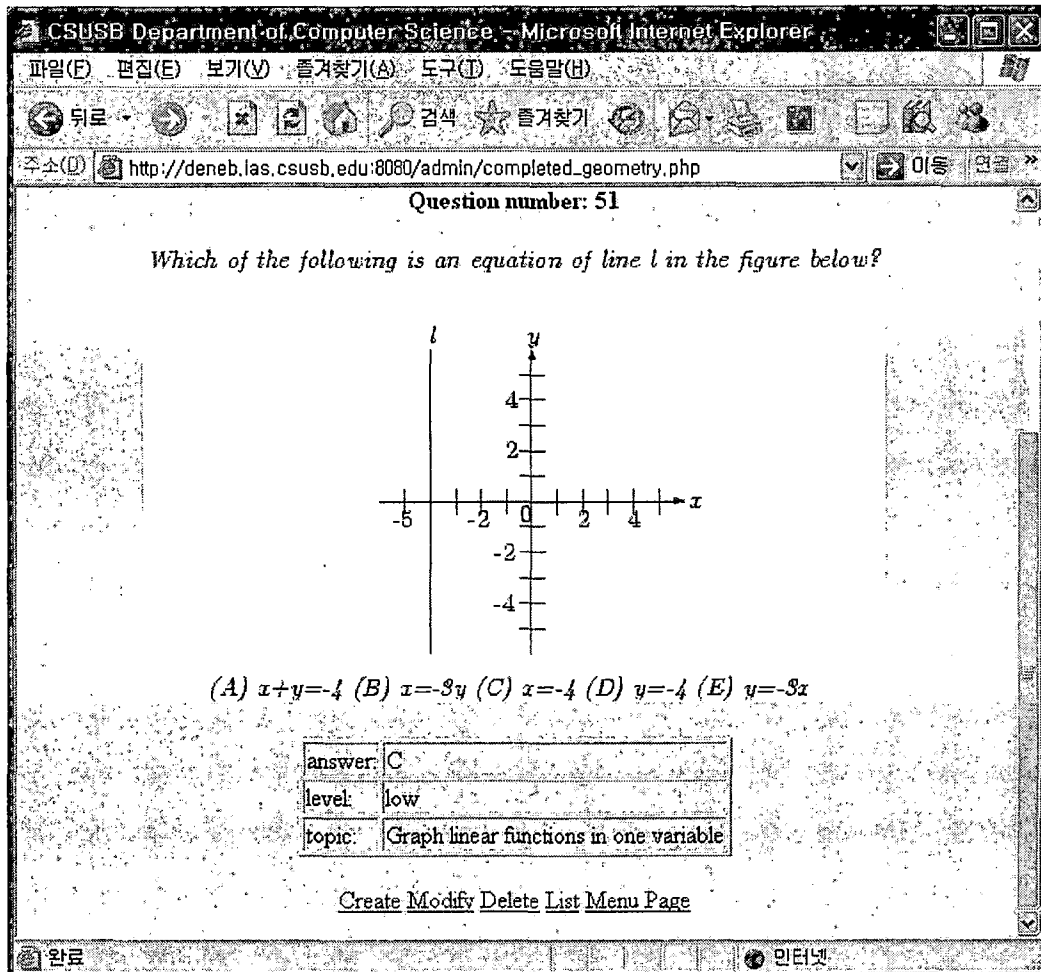


Figure 4.15 Completed Geometry Question

- Check for the New Geometry Question in List Page.

On this page, the administrator can check the new question to be or not to be on the geometry question list.

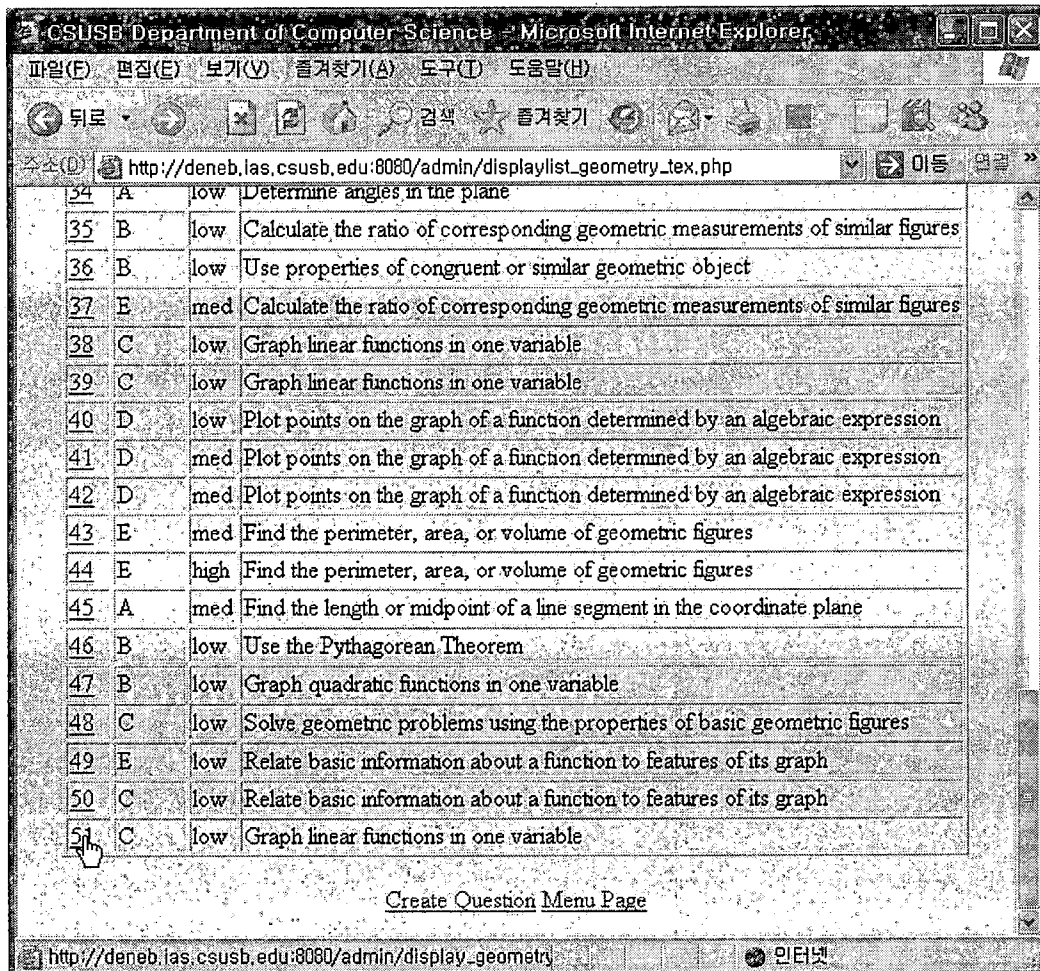


Figure 4.16. Check for the New Geometry Question in List.

- All Students ELM Test Score Page. On this page, the administrator can check the results of all students' ELM test scores. Here, by clicking on the headers for student_ID, ID, and each test, the test

scores can be viewed in increasing order of
 student_id, id, test scores for the selected test.

CSUSB Department of Computer Science - Microsoft Internet Explorer

주소(D) http://deneb.las.csusb.edu:8080/admin/score.php

Self Assessment Test

Entry Level Mathematics

California State University, San Bernardino

You are logged in as administrator.

S_id	id	no time test1	no time test2	no time test3	time test1	time test2	time test3
111-11-1111	obaek	42	48	47	40	19	24
222-22-2222	jyang	45	46	47	47	48	49
333-33-3333	syang	42	43	42	45	46	47
444-44-4444	dkim	25	27	30	31	32	34
555-55-5555	jlee	32	33	35	35	36	37
777-77-7777	slee						
666-66-6666	djang	35	36	39	35	34	38

[Menu Page](#)

Figure 4.17. All Students' ELM Test Score Page.

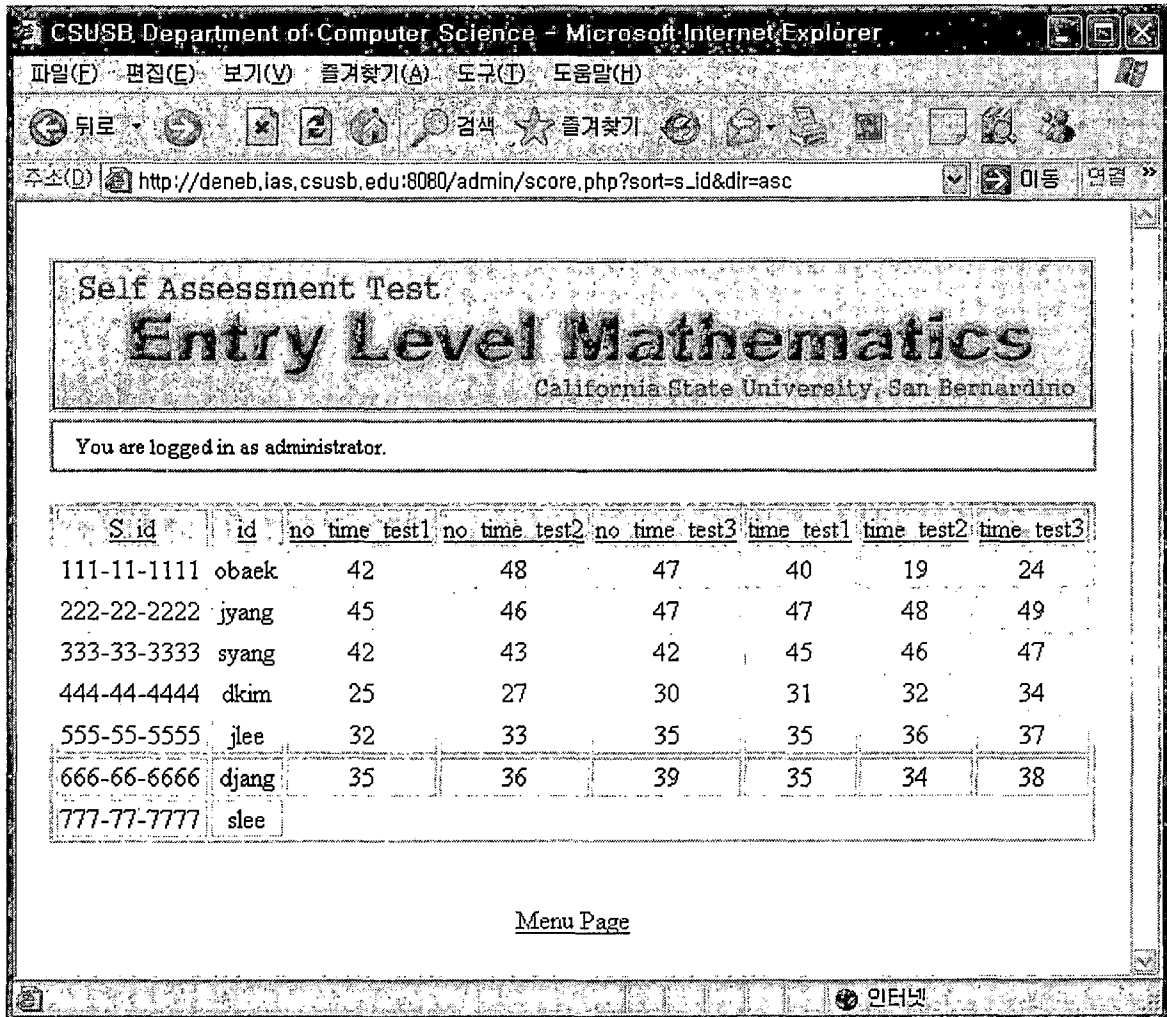


Figure 4.18 Screenshot of Listing by Increasing S_id.

CSUSB Department of Computer Science - Microsoft Internet Explorer

파일(F) 편집(E) 보기(V) 즐겨찾기(A) 도구(T) 도움말(H)

뒤로 · 앞으로 · 홈 · 검색 · 즐겨찾기 · 인터넷 옵션 · 다운로드 · 인쇄 · 연결

주소(D) http://deneb.ias.csusb.edu:8080/admin/score.php?sort=id&dir=asc 이동 연결

Self Assessment Test

Entry Level Mathematics

California State University, San Bernardino

You are logged in as administrator.

S id	id	no time test1	no time test2	no time test3	time test1	time test2	time test3
666-66-6666	djang	35	36	39	35	34	38
444-44-4444	dkim	25	27	30	31	32	34
555-55-5555	jlee	32	33	35	35	36	37
222-22-2222	jyang	45	46	47	47	48	49
111-11-1111	obaek	42	48	47	40	19	24
777-77-7777	slee						
333-33-3333	syang	42	43	42	45	46	47

[Menu Page](#)

인터넷

Figure 4.19 Screenshot of Listing by Increasing id.

CSUSB Department of Computer Science - Microsoft Internet Explorer

파일(F) 편집(E) 보기(V) 즐겨찾기(A) 도구(T) 도움말(H)

뒤로 - - - - - 검색 * 즐겨찾기 - - - - - 이동 연결 >>

주소(D) http://deneb.ias.csusb.edu:8080/admin/score.php?sort=no_time_test1&dir=asc

Self Assessment Test

Entry Level Mathematics

California State University, San Bernardino

You are logged in as administrator.

S id	id	no time test1	no time test2	no time test3	time test1	time test2	time test3
777-77-7777	slee						
444-44-4444	dkim	25	27	30	31	32	34
555-55-5555	jlee	32	33	35	35	36	37
666-66-6666	djang	35	36	39	35	34	38
111-11-1111	obaek	42	48	47	40	19	24
333-33-3333	syang	42	43	42	45	46	47
222-22-2222	jyang	45	46	47	47	48	49

[Menu Page](#)

http://deneb.ias.csusb.edu:8080/admin/score.php?sort=no_time_test1&dir=asc 인터넷

Figure 4.20 List by Increasing Scores for UnTimed-Test1.

CSUSB Department of Computer Science - Microsoft Internet Explorer

파일(F) 편집(E) 보기(V) 즐겨찾기(A) 도구(T) 도움말(H)

뒤로 · 앞으로 · 검색 · 즐겨찾기 · 이동 · 연결

주소(D) http://deneb.ias.csusb.edu:8080/admin/score.php?sort=no_time_test2&dir=asc

Self Assessment Test

Entry Level Mathematics

California State University, San Bernardino

You are logged in as administrator.

S id	id	no time test1	no time test2	no time test3	time test1	time test2	time test3
777-77-7777	slee						
444-44-4444	dkim	25	27	30	31	32	34
555-55-5555	jlee	32	33	35	35	36	37
666-66-6666	djang	35	36	39	35	34	38
333-33-3333	syang	42	43	42	45	46	47
222-22-2222	jyang	45	46	47	47	48	49
111-11-1111	obaek	42	48	47	40	19	24

[Menu Page](#)

인터넷

Figure 4.21 List by Increasing Scores for UnTimed-Test2.

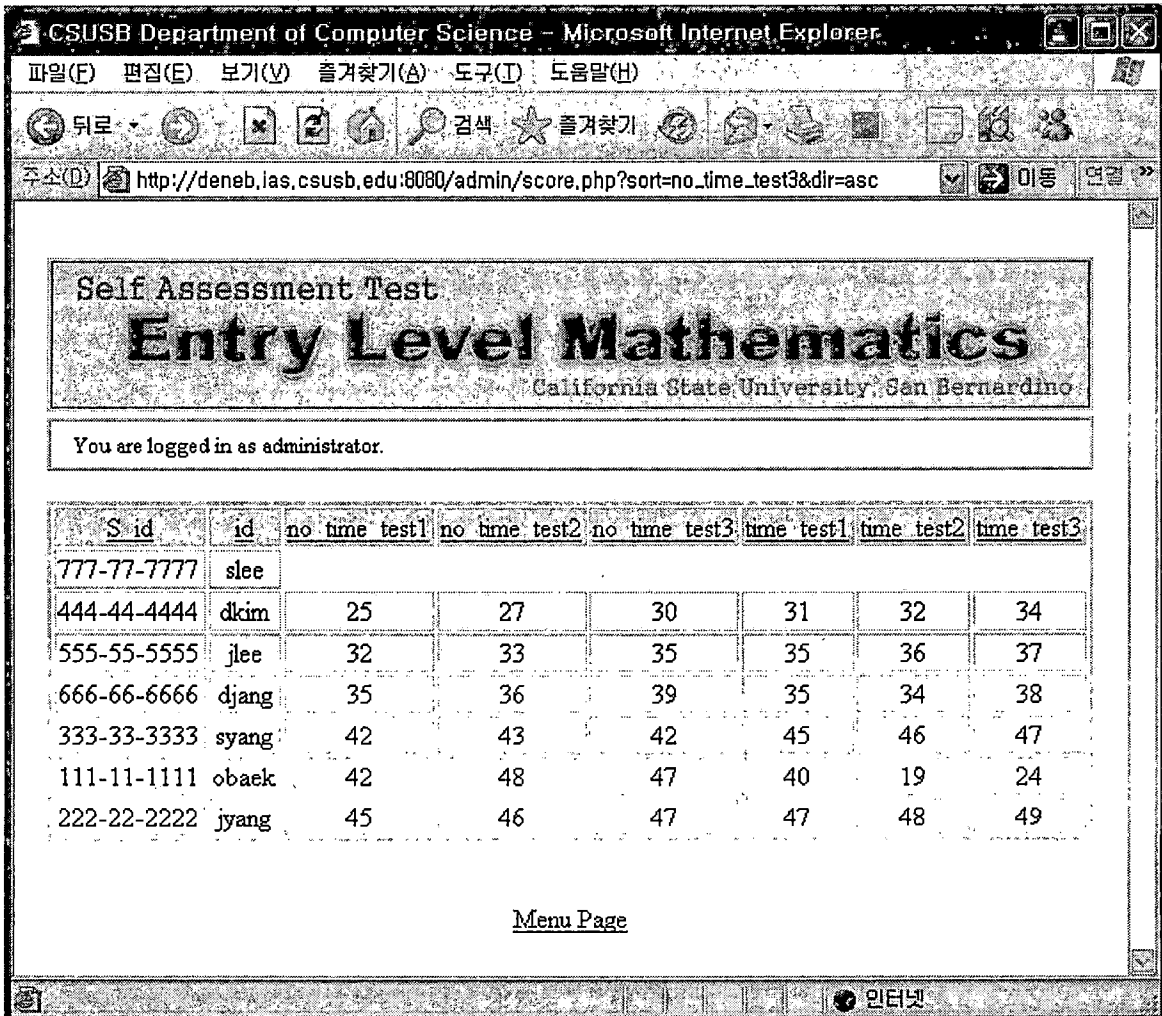


Figure 4.22 List by Increasing Scores for UnTimed-Test3.

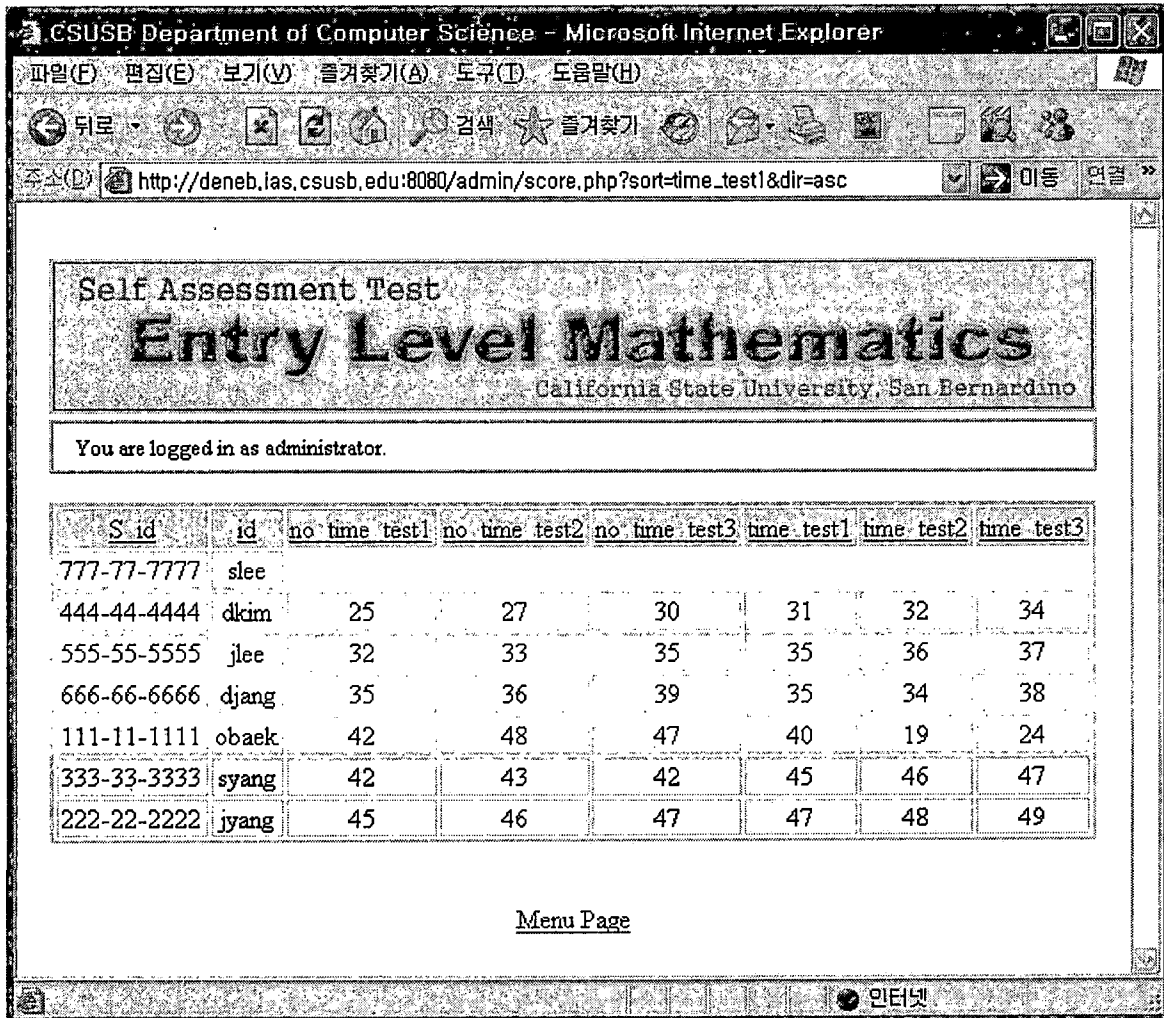


Figure 4.23 List by Increasing Scores for Timed-Test1

CSUSB Department of Computer Science - Microsoft Internet Explorer

파일(F) 편집(E) 보기(V) 즐겨찾기(A) 도구(T) 도움말(H)

뒤로 · 검색 · 즐겨찾기 · 이동 · 연결 >>

주소(D) http://deneb.ias.csusb.edu:8080/admin/score.php?sort=time_test2&dir=asc

Self Assessment Test

Entry Level Mathematics

California State University, San Bernardino

You are logged in as administrator.

S id	id	no time test1	no time test2	no time test3	time test1	time test2	time test3
777-77-7777	slee						
111-11-1111	obaek	42	48	47	40	19	24
444-44-4444	dkim	25	27	30	31	32	34
666-66-6666	djang	35	36	39	35	34	38
555-55-5555	jlee	32	33	35	35	36	37
333-33-3333	syang	42	43	42	45	46	47
222-22-2222	jyang	45	46	47	47	48	49

[Menu Page](#)

인터넷

Figure 4.24 List by Increasing Scores for Timed-Test2

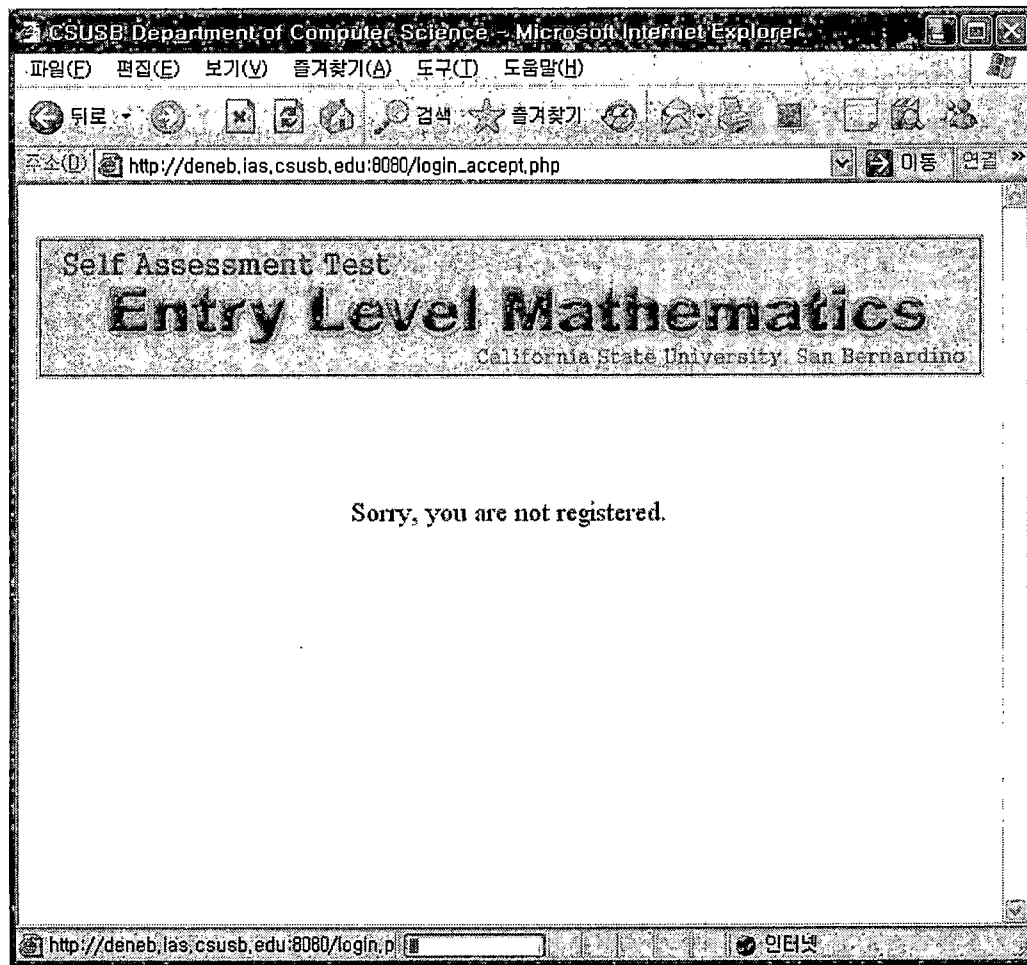


Figure 4.26. Student Login Error Page.

- A New Student Password Error Page. If a student's password and confirm password are not identical, a password error message appears.

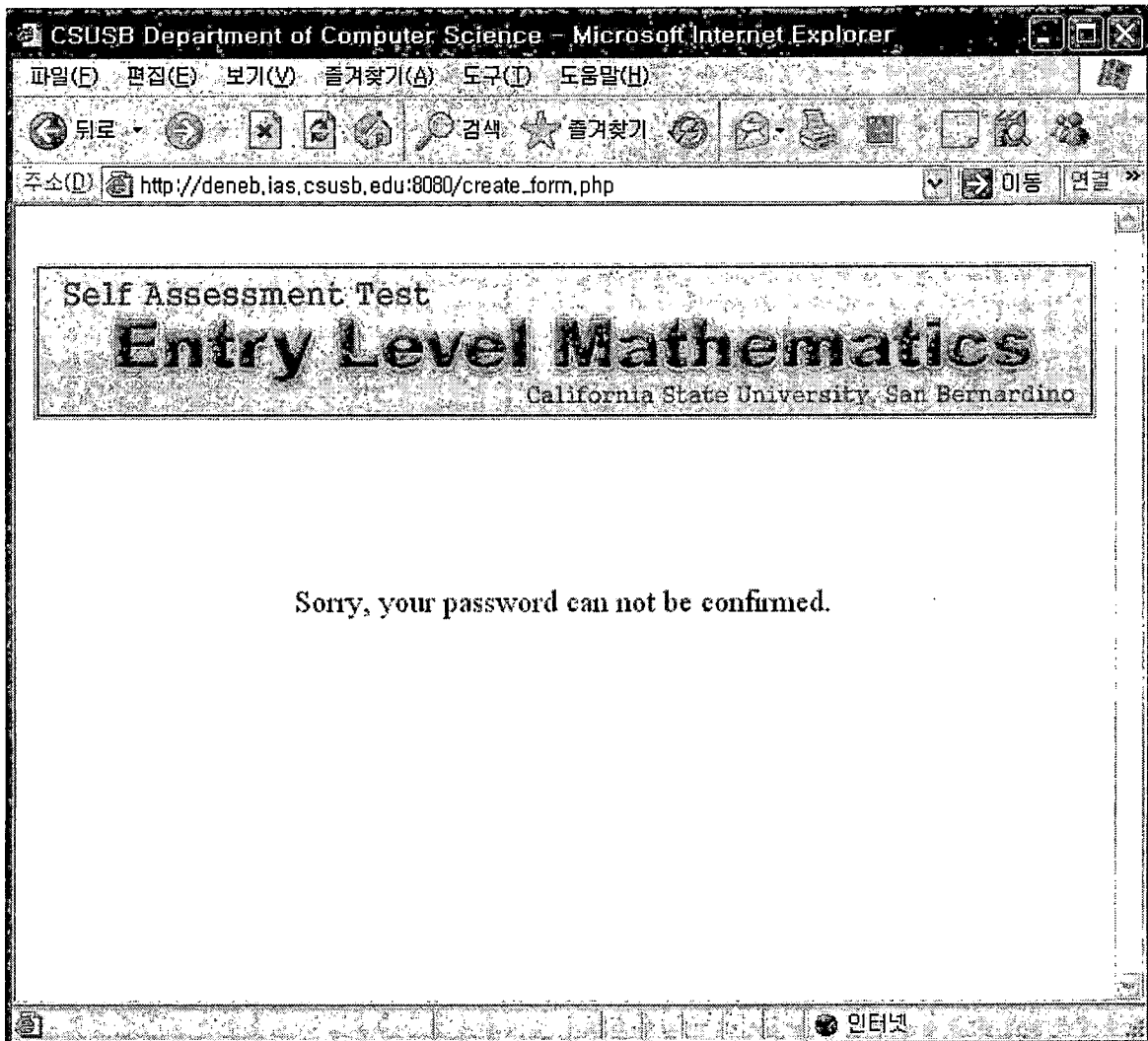


Figure 4.27. New Student Password Error Page.

- Score of UnTimed Test1 Page. On this page, the student can check his/her score of the untimed test1.

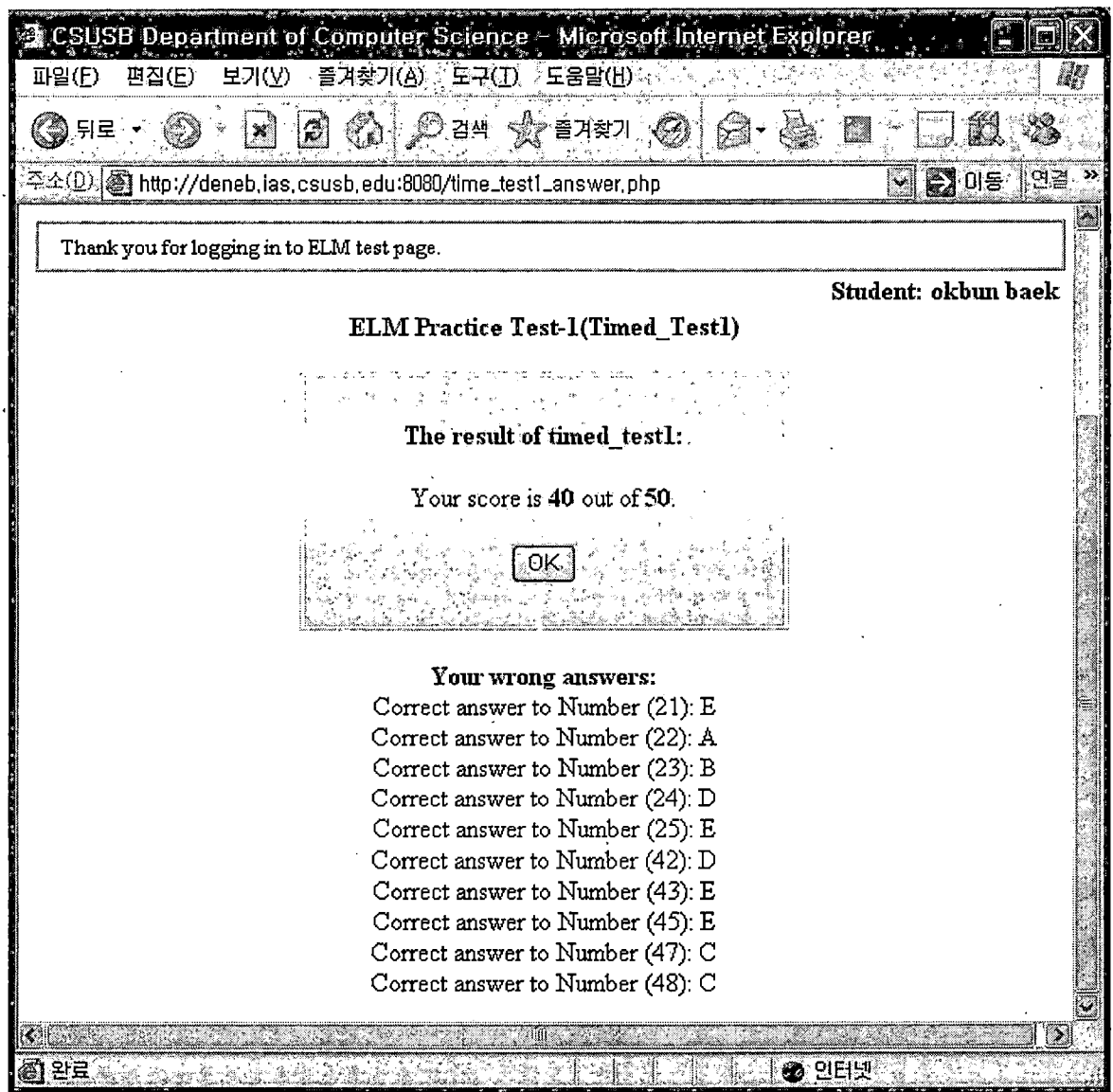


Figure 4.29. Screenshot of Timed-Test1 Score Page

- Check for Taken New Test and All Test Scores. On this page, student can check his/her new taken test score and all test scores.

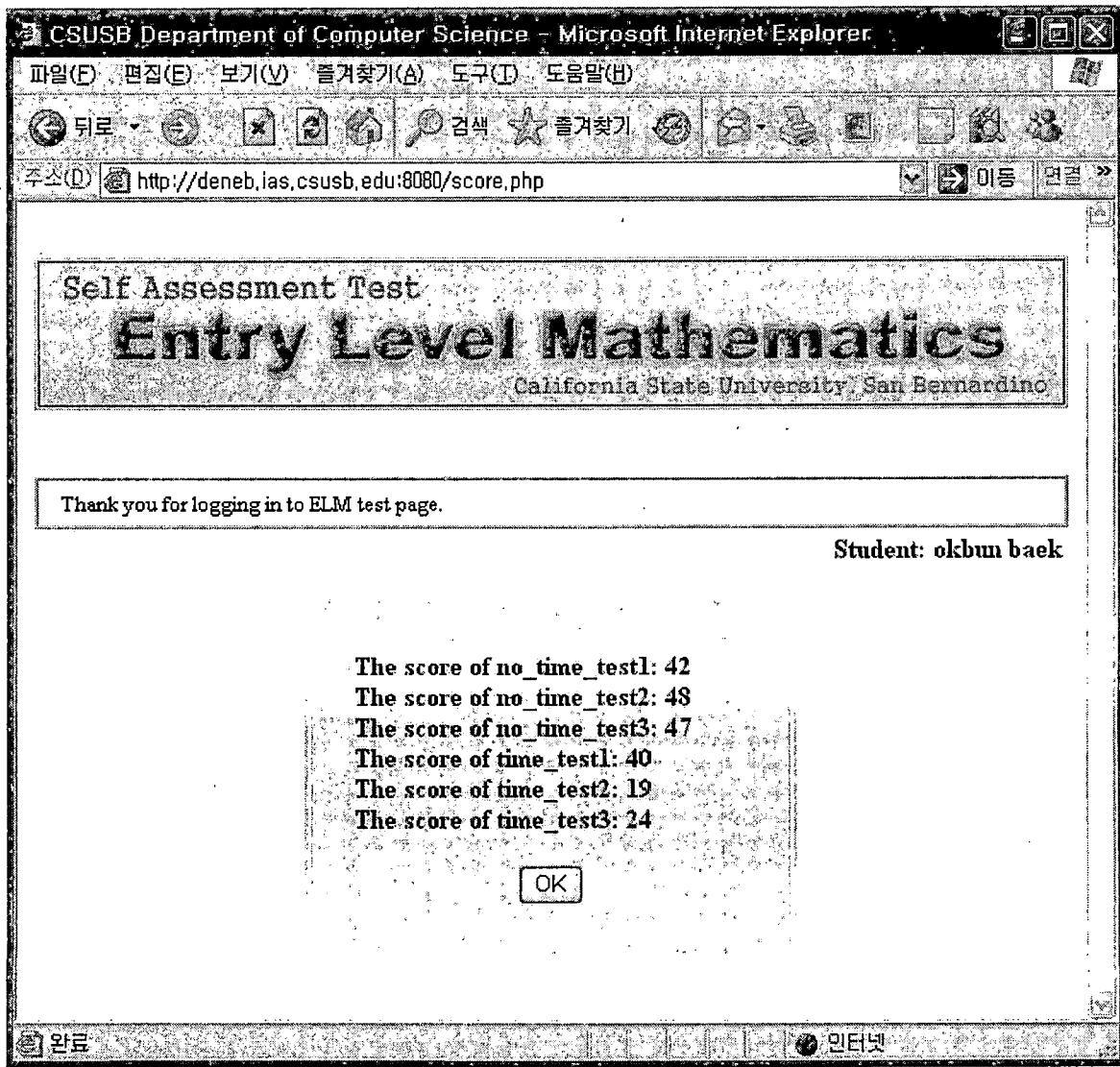


Figure 4.30. Taken New Test and All Test Scores

CHAPTER FIVE

INSTALLATION AND MAINTENANCE

5.1 Directory Structure

Following Web technology, the root directory of WebELMT is the Apache Web server documentation directory. All php scripts are in WebELMT root directory.

- Root - root directory of WebELMT and its absolute directory is /var/www/html.
- Admin - There are administrator's all PHP scripts.
- Cache - There are LaTeX PNG files.
- Images - Banner files which are used on WebELMT are in this directory.

5.2 Installation

This software is for the system administrator who is an expert in Linux, MySQL, PHP, and LaTeX. Therefore, this documentation skips the basic installation procedure for Linux, MySQL, Apache, and PHP. Particularly, system administrator downloaded LaTeX source files from the Internet. The next step is the installation of the database. The databases are already backed up and saved

in CD, so just restore them in the MySQL. All databases are backed up in 'welms_DB.sql'. The command line, "mysql -u root -p < welms_DB.sql" will install the databases.

5.3 Database Maintenance

Before WebELMT starts run, WebELMT needs a MySQL account to create its database. The system administrator will create a Mysql account for WebELMT. To create a user account on Mysql and to assign a database to WebELMT, the systems administrator takes the following steps:

1. #> mysql -u root -p welm

This command will prompt root password.

2. mysql> insert into user (host, user, password)
values ('localhost', 'root', password('welms-
password')); This command creates a user root.

3. mysql> create database welm;

This command creates database welm.

4. mysql> insert into db (host, user, db, select_priv)
values ('localhost', 'root', 'welms', 'Y');

This command gives select privileges on welms database to user root.

5. mysql> flush privileges;

This command flushes all privileges.

CHAPTER SIX

CONCLUSIONS AND FUTURE WORK

6.1 Conclusion

As the number of students at CSUSB increases, the importance of the ELM examination will become greater as well. Students' mathematical ability in high school is often inadequate. Therefore, for the passing in the ELM exam is difficult. A Web-site to practice the ELM test is not yet on the Internet. My project, WebELMT, addresses this need. WebELMT is convenient and effective because students can take the ELM tests and practice three major tests (numbers and data, algebra, geometry) separately and repeatedly. Students can also practice timed (90 minutes) ELM tests. One advantage of WebELMT is that mathematics questions are formatted in LaTeX. The LaTeX document system is extremely well suited for math and science content. So, by practicing WebELMT several times, he/she can pass ELM exam easily and quickly.

6.2 Future Work

On WebELMT, three ELM tests are set-up. The three tests are not enough to prepare for the ELM test. Future work on WebELMT is to create and save more questions in the database. In addition, the system administrator must set-up more the entire ELM tests from the three major (Numbers and Data, Algebra, Geometry) questions. In conclusion, the administrator should organize the WebELMT for student to practice the ELM test more conveniently.

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